



560MHz DIGITAL FREQUENCY METER

TF 2432

FOR SERVICE MANUALS
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Instruction Manual

H 52432-900H
Change No. C4

EQUIPMENT TF 2432
TITLE 500 MHz Digital Frequency Meter
CODE NOS. 52432-301T & -302P
SER. NOS. Within series prefixed J 186772 and
above
ACCOMPANYING
DOCUMENTS None

For use with
manual issue
1a - 12/76,
1b - 10/77 and
1c - 6/78.

MANUAL CHANGE

Unit A11

(Parts list, p.27
Circuit diagram, p.37)

MI code

Change R6 to Met film 360Ω 2% $\frac{1}{4}$ W
and TR3 to BC171A

24773-262T
28455-421X

H 52432-900H
Change No. C3

EQUIPMENT ... TF 2432
TITLE 500 MHz Digital Frequency Meter
CODE NOS. 52432-301T & -302P
SER. NOS. Within series prefixed J 186748 and above
ACCOMPANYING
DOCUMENTS ... None

For use with
manual issue
... 1a-12/76
and 1b - 10/77

MANUAL CHANGE

Unit A1

(Parts list, p. 20
Circuit diagram, p.31)

Change C19 to Cer .001 μ F -20 +80% 500V

MI code

26383-242P

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TITLE..... 560 MHz Digital Frequency Meter

CODE No..... 52342-301T,-302P

SER.NOS.

PREFIXED.... 186776 onwards

ACCOMPANYING

DOCUMENTS... None

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MANUAL CHANGE

Input filter

A filter which gives improved noise immunity for low frequency measurements has been added to the input circuit of the counter. The filter is formed by the existing components R1 and C2. Input coupling capacitor C1 has been taken from its existing position between l.f. input connector SKA and the junction of R1 and C2 and inserted between the opposite end of the R1 C2 network and the junction of D1 and D2 etc. Switch SH has been added and is mounted on the front panel to the right of the l.f. input socket. When the filter is switched OUT, R1 and C2 are connected in parallel. When the filter is switched to IN, C2 is disconnected from the input end of R1 and earthed so that it forms the shunt element of a low-pass filter with R1 as the series input element. The filter provides approximately 20 dB of attenuation at 100 kHz.

Amendments to manual

Chap. 1

Page 4 : Add the following:

LF FILTER

Switchable low-pass filter reduces sensitivity above 10 kHz to improve noise immunity when counting l.f. signals.
(Attenuation at least 20 dB above 100 kHz.)

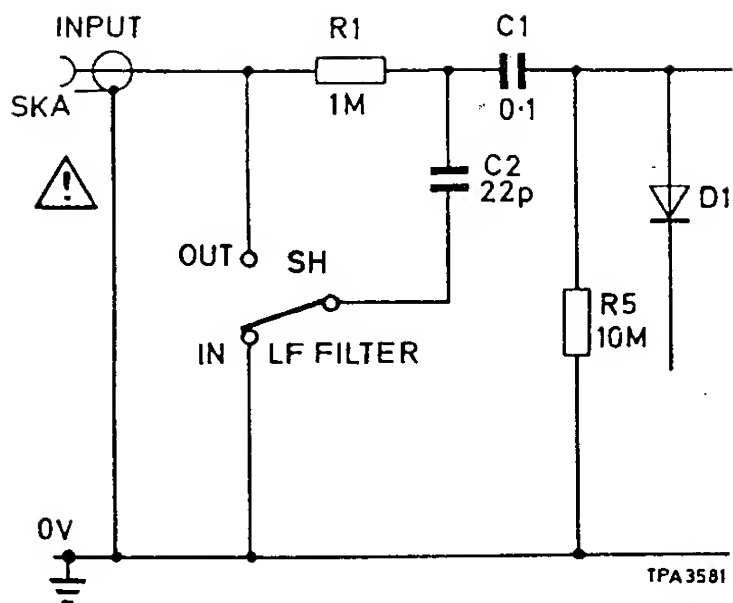
Chap. 6

Page 24 : Add: SH LF FILTER s.p.d.t. 23462-2522

Chap. 7

Fig. 7.2 : Function board A1

Amend the diagram to incorporate the l.f. filter switch and associated components as shown on the following diagram.



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ST. ALBANS HERTFORDSHIRE ENGLAND.

SAFETY PRECAUTIONS

- For inclusion in instruction manuals for mains operated equipment -

This equipment is protected in accordance with IEC Safety Class 1. It has been designed and tested according to IEC Publication 348, 'Safety Requirements for Electronic Measuring Apparatus', and has been supplied in a safe condition. The following precautions must be observed by the user to ensure safe operation and to retain the equipment in a safe condition.

Defects and abnormal stresses

Whenever it is likely that protection has been impaired, for example as a result of damage caused by severe conditions of transport or storage, the equipment shall be made inoperative and be secured against any unintended operation.

Removal of covers

Removal of the covers is likely to expose live parts although reasonable precautions have been taken in the design of the equipment to shield such parts. The equipment shall be disconnected from the supply before carrying out any adjustment, replacement or maintenance and repair during which the equipment shall be opened. If any adjustment, maintenance or repair under voltage is inevitable it shall only be carried out by a skilled person who is aware of the hazard involved.

Note that capacitors inside the equipment may still be charged when the equipment has been disconnected from the supply. Before carrying out any work inside the equipment, capacitors connected to high voltage points should be discharged; to discharge mains filter capacitors, if fitted, set the equipment supply switch to ON.

Mains plug

The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action shall not be negated by the use of an extension lead without protective conductor. Any interruption of the protective conductor inside or outside the equipment is likely to make the equipment dangerous.

Fuses

Note that the supply fuse is connected in series with the brown (live) wire of the supply lead. If the equipment is connected to the supply via a two-pin plug, it will be possible for the fuse to become connected to the neutral side depending upon the orientation of the plug in its socket. In these circumstances certain parts of the instrument could remain at supply potential even after the fuse has ruptured.

To provide protection against breakdown of the supply lead, its connectors, and filter where fitted, an external supply fuse (e.g. fitted in the connecting plug) should be used in the live lead. The fuse should have a continuous rating not exceeding 6 A.

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of mended fuses and the short-circuiting of fuse holders shall be avoided.

Instruction Manual
No. H 52432-900H
for

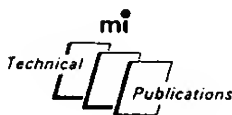
560 MHz Digital Frequency Meter TF 2432

Code Nos. 52432-301T and 52432-302P

RADIO FREQUENCY INTERFERENCE

This equipment conforms with the requirements of EEC Directive 76/889 as to limits of r.f. interference.

H 54881-0300:C1



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1.1 INTRODUCTION

TF 2432 is a general purpose instrument suitable for measuring the frequency of signals in the band 10 Hz to 560 MHz. Its versatile input buffer and amplifier incorporating a.g.c. has a high tolerance of signal distortion and noise and ensures reliable operation over a wide dynamic range of input levels without the need for a manual control.

The counter has a bright 8-digit, 7-segment l.e.d. display with memory, automatic position of

decimal point, leading zero suppression and active indication of overflow, hold and external standard operation. Push button switches select the resolution required, the maximum being 0.1 Hz over the entire frequency range.

Gate times are derived from an internal 10 MHz crystal oscillator or from an external standard if required. The high-stability alternative version of the instrument Code No. 52432-302P is fitted with an oven-controlled internal 10 MHz standard.

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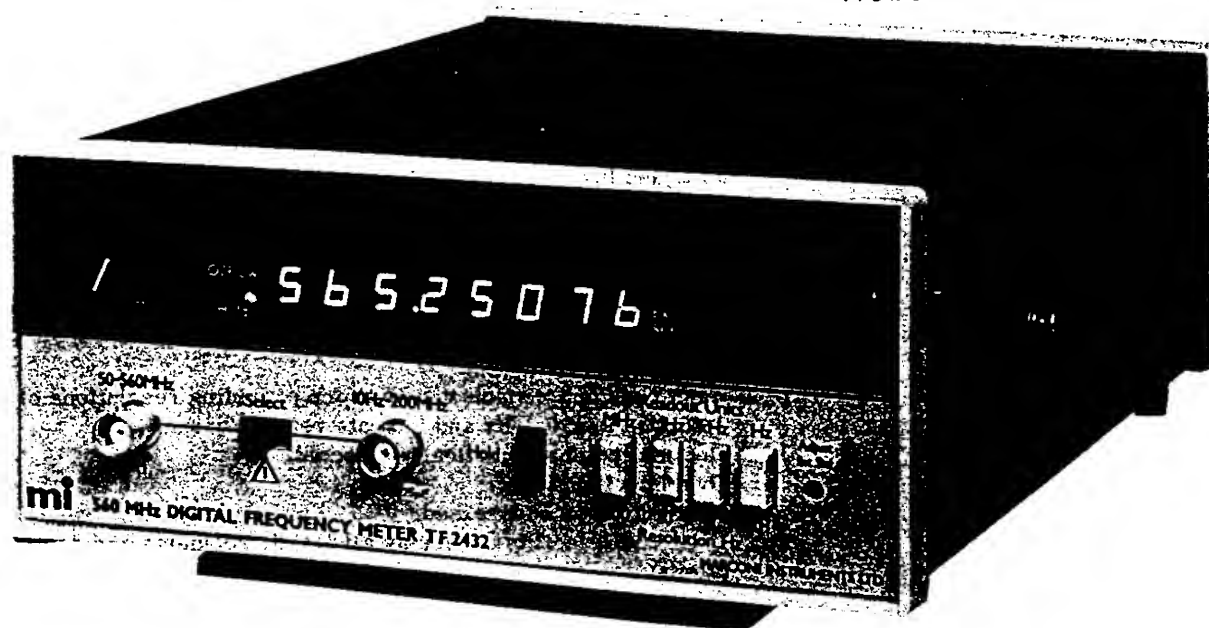


Fig. 1.1 560 MHz Digital Frequency Meter TF 2432

1.2 DATA SUMMARY

INPUT CHANNELS :

Switch selected l.f. and h.f. input channels cover a total frequency range of 10 Hz to 560 MHz.

LF INPUT

Frequency range :

10 Hz to 200 MHz.

Sensitivity* :

10 mV r.m.s. sine wave from 10 Hz to 70 MHz.
25 mV r.m.s. sine wave from 70 MHz to 200 MHz.
Built-in a.g.c. provides capability for handling signals over a dynamic range of up to 90 dB automatically.

Maximum input :

260 V r.m.s. at 50 Hz nominal (sine wave),
5 V r.m.s. at 200 MHz (sine wave).
Maximum d.c. : 250 V.
Maximum a.c. + d.c. : 250 V r.m.s. at nominal 50 Hz,
decreasing from 50 Hz to 200 MHz by approx. 1.3×10^{-6} V/Hz.

Input impedance :

Approx. 1 M Ω in parallel with less than 25 pF. AC coupled via 0.1 μ F.

HF INPUT

Frequency range :

50 MHz to 560 MHz.

Sensitivity* :

10 mV r.m.s. sine wave.
Built-in a.g.c. provides capability for handling signals over a dynamic range of up to 54 dB automatically.

Maximum input :

5 V r.m.s. from 50 MHz to 560 MHz.
Maximum d.c. : 5 V.

Input impedance :

50 Ω nominal.

DISPLAY :

8 digits with memory. (7 segment l.e.d's of 7 mm minimum height).

Units and resolution :

Four push buttons select gate times providing resolutions of 100, 10, 1 or 0.1 Hz and indicate readout units.
Decimal point automatically selected.
Overflow indication.
Leading zeros suppressed.
Digit check facility to display all l.e.d. segments and decimal points.

Display time :

Readout retained during gating period or held indefinitely by means of HOLD button.

* Sensitivity is specified in terms of p.d. measured at the input socket.

ACCURACY : ± 1 count \pm stability of frequency standard.

FREQUENCY STANDARD : Internal crystal oscillator or external standard automatically selected. (Application of external signal overrides internal oscillator.) Front panel indication when external standard is selected.

INTERNAL CRYSTAL OSCILLATOR (Version 52432-301T)

Frequency : 10 MHz.

Adjustment range : Compensation for ageing drift may be made by a front panel preset.

Temperature stability : Within ± 5 parts in 10^6 over the operating temperature range of the instrument.

Ageing rate : Approx. ± 2 parts in 10^9 per day at a constant temperature.

Auxiliary output level : Internal standard available at rear panel at approx. 2 k Ω source impedance. Greater than 130 mV p-p into 50 Ω .

INTERNAL CRYSTAL OSCILLATOR (Version 52432-302P)

Frequency : 10 MHz.

Adjustment range : Compensation for ageing drift may be made by a front panel preset.

Temperature stability : Within ± 1 part in 10^7 over the operating temperature range of the instrument.

Ageing rate : ± 1 part in 10^7 nominal per week after 1 month continuous use.

Warm-up time : Stabilizes to within ± 1 part in 10^6 of final value in 5 minutes from switch-on at ambient temperatures above +20°C.

Auxiliary output level : Internal standard available at rear panel at approx. 2 k Ω source impedance. Greater than 130 mV p-p into 50 Ω .

EXTERNAL INPUT

Frequency : Rear panel switch selects 100 kHz or 1 MHz input for frequency measurement. Useable from 10 kHz to 10 MHz for ratio measurement.

Input impedance : Approx. 1 M Ω in parallel with less than 25 pF.

OPERATING TEMPERATURE RANGE : 0 to 40°C.

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POWER REQUIREMENTS

AC mains :	95 to 130 V (115 V nominal), 190 to 264 V (230 V nominal).
Frequency :	45 to 500 Hz.
Consumption :	15 VA approx.

DIMENSIONS AND WEIGHT :	Height	Width	Depth	Weight
	100 mm (4 in)	220 mm (8 3/4 in)	310 mm (12 in)	2.2 kg (4 3/4 lb)

1.3 VERSIONS AND ACCESSORIES

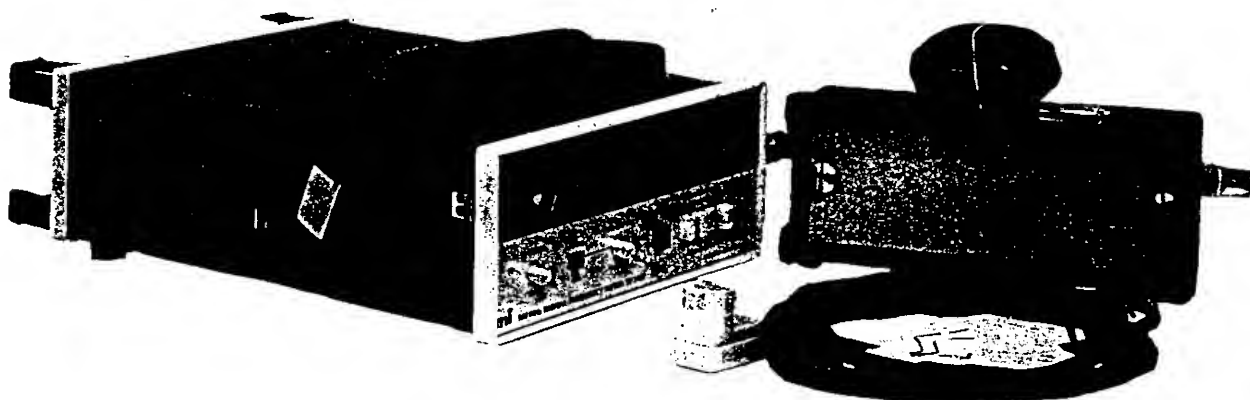


Fig. 1.2 Instrument complete with accessory kit

<u>Versions</u>	MI code	<u>Optional accessories</u>	MI code
Standard version	52432-301T	Accessory kit comprising :-	46883-281N
Alternative version with stability internal frequency standard	52432-302P	Stowage lid Rear stand Hand strap Shoulder strap Right angle entry mains lead	
<u>Supplied accessories</u>		Rack mounting tray	46883-282L
Mains lead (detachable)	43123-076Y	Coaxial lead, 1 m long, with BNC plug at each end	43126-013W

2.1 INSTALLATION

The instrument is supplied ready for bench mounting but a rack mounting tray is available as an accessory. This consists of a housing with two compartments either of which will accommodate a TF 2432 without its case. The other compartment is covered with a blank panel or can be used to house a second TF 2432 or similarly sized instrument. Full fitting instructions are supplied with the tray.

The mains lead supplied is a free cable fitted at one end with a socket that connects with the 3-pin plug at the rear of the instrument. When fitting a mains plug to the lead make sure the following colour coding is observed :-

Live - Brown
Neutral - Blue
Earth - Green/Yellow

Before connecting the instrument to the power supply, check that the AC SUPPLY switch at the rear is correctly set and that the corresponding value of fuse is fitted. The instrument is normally despatched with the switch set to 230 V, i.e. for operation from 190 to 264 V supplies.

To change to the 95 to 130 V supply range remove the switch locking plate, switch to 110 V and refit the plate to suit. Note that the fuse must also be changed to the rating indicated beside the switch.

2.2 CONTROLS AND CONNECTORS

Front panel

- ① SUPPLY switch - Turn clockwise to switch on. The display will illuminate when supply is on.
 - ② SELECT switch - For l.f. or h.f. input channel.
- ⚠ CAUTION : Do not exceed the maximum a.c. or d.c. input levels stated in Sect. 1.2 - Data Summary.
- ③ HF INPUT socket - 50 MHz to 560 MHz range. BNC 50 Ω connector.
 - ④ LF INPUT socket - 10 Hz to 200 MHz range. BNC 50 Ω connector.

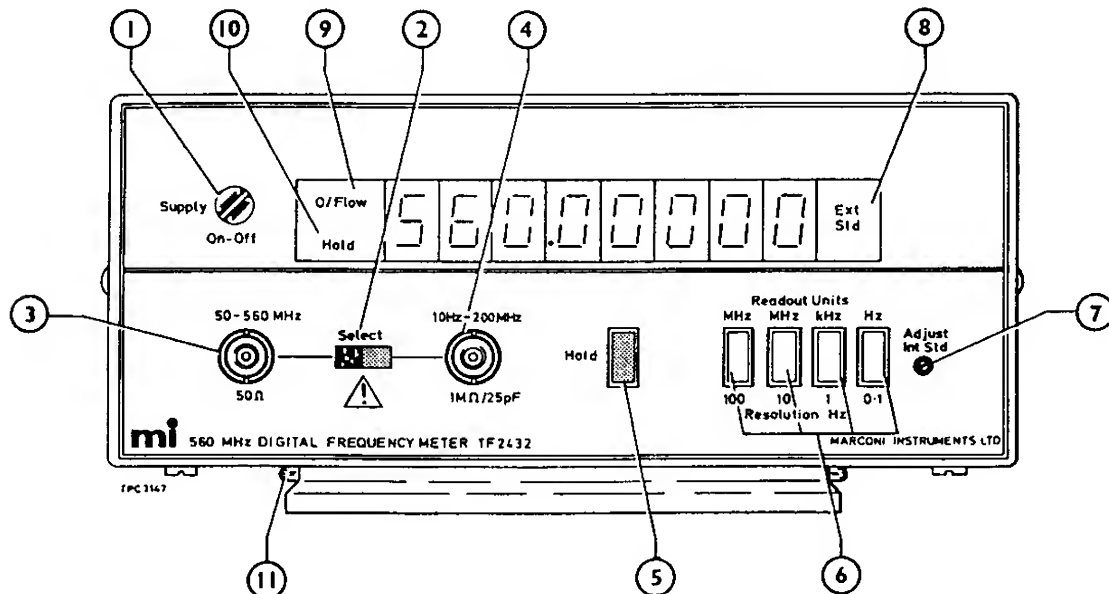


Fig. 2.1 Front panel controls and connectors

- ⑤ **HOLD** - Push button action prevents the memory being updated. This allows the display to be retained indefinitely even if the input is removed. Push again to release and allow updating of the memory to continue.
- ⑥ **READOUT UNITS** - Four interlocking push buttons select gate time and hence resolution and decimal point position.
- ⑦ **ADJ INT STD** - A screwdriver adjustable trimmer with 10 turns allows fine adjustment of the internal frequency standard (see Sect. 4.5).
- ⑧ **EXT STD indicator** - Shows that rear panel 10 MHz STANDARD - EXT has been selected.
- ⑨ **O/FLOW indicator** - Shows that the most significant digit or digits have overflowed the display.
- ⑩ **HOLD indicator** - Shows that HOLD button has been engaged.
- ⑪ **SUPPORT** - Hinges down to raise the front of the instrument.

Rear panel

EXT STANDARD - 50 Ω BNC socket accepts 1 MHz or 100 kHz signal depending on setting of switch. Signal applied here overrides the internal standard.

INT STANDARD - 50 Ω BNC socket provides 1 MHz output from internal oscillator.

CAUTION : Do not exceed 10 V r.m.s. p-p at the EXT STD socket at 100 kHz or 1 MHz. No damage will be caused to the instrument if voltage inputs up to 250 V r.m.s. at 50 Hz are applied.

AC SUPPLY - Position of locking plate allows switch to select either 230 V or 110 V supply and reveals appropriate fuse rating.

2.3 FREQUENCY MEASUREMENT

- (1) Set the SELECT switch to suit the input frequency and connect the signal to be measured to the selected input socket.
- (2) The instrument is controlled from its internal 1 MHz standard unless an external standard is connected as in Sect. 2.4.
- (3) Select the required READOUT UNITS, noting the corresponding resolution figure, i.e. the value of the smallest units in the display. The decimal point position, readout calibration and gate and display times are shown in Fig. 2.2.

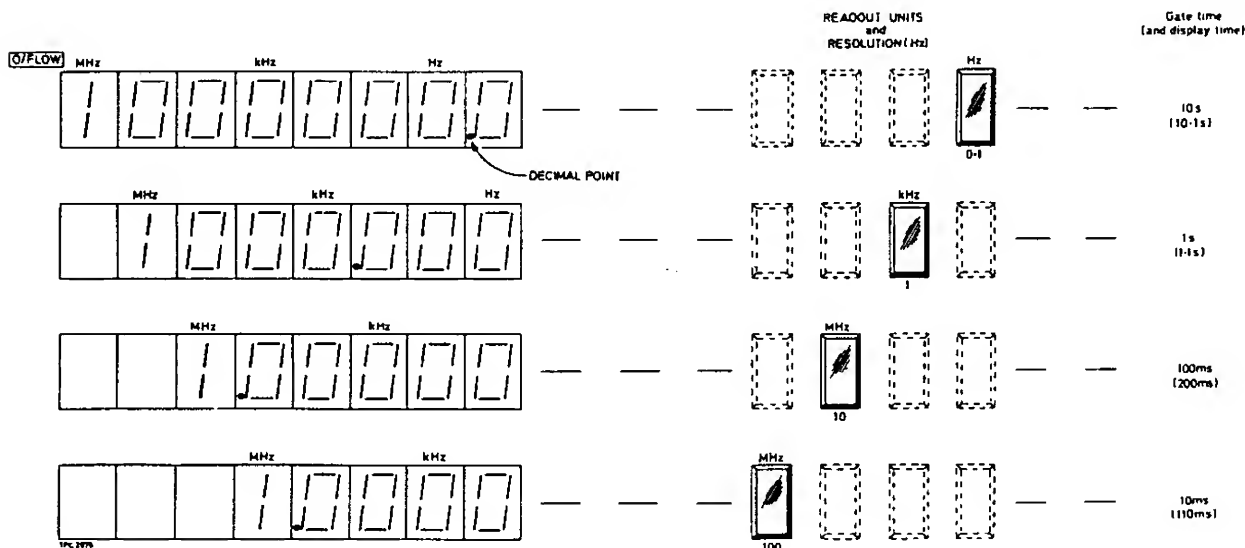


Fig. 2.2 Readout calibration and display data for a 10 MHz signal

- (4) If the resolution selected results in a display of more than 8 digits the overflow indicator illuminates and the most significant digits are 'lost'.

The display will be updated at the intervals shown in Fig. 2.2 unless the HOLD button is pressed. In this case the HOLD indicator will light and the display will be held indefinitely, even if the input signal is removed.

2.4 USE OF EXTERNAL STANDARD

A 100 kHz or 1 MHz external standard can be used in place of the internal 1 MHz standard. To do this, set the rear panel EXT STD to 100 kHz or 1 MHz as appropriate and connect the external standard signal to the associated socket. This automatically overrides the internal standard and causes the front panel EXT STD indicator to light.

2.5 SELF CHECK PROCEDURE

A simple test to show that the instrument is working correctly can be performed by using it to measure its own standard output. This does not,

of course, verify the accuracy of indication since any error in the standard will be cancelled by a corresponding error in the gating time which is derived from the same source.

To do the test proceed as follows :

- (1) Connect the 1 MHz INT STD socket to the selected INPUT socket and terminate the signal into 50 Ω by using a T-connector.
- (2) Remove any connection to the EXT STD socket.
- (3) Select each of the READOUT UNITS in turn and check that the readout is within ± 1 count of that shown in Fig. 2.2.
- (4) Press the HOLD button and check that the HOLD indicator lights and that the readout is retained when the input lead is disconnected.

2.6 DIGIT CHECK PROCEDURE

To verify that the readout display tubes are all working correctly, disengage the four READOUT UNITS buttons and the HOLD button. All l.e.d. segments and decimal points should now be illuminated.

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3.1 INPUT AMPLIFIER, GATE AND HIGH SPEED DECADES

LF input

The input signal is fed into an input buffer comprising a dual gate m.o.s. f.e.t. and emitter follower whose gain and, for high level signals, attenuation can be controlled by a d.c. voltage applied to the m.o.s. f.e.t. The output of the buffer is detected and converted into a proportional d.c. voltage which controls the buffer.

The output signal from the subsequent wide band amplifier is of constant amplitude and its level just exceeds the hysteresis window of the Schmitt trigger thus ensuring reliable triggering even when the signal has a poor signal-to-noise ratio.

The output from the Schmitt trigger, when selected by a relay, is fed to the input of the high speed i.c. decade which contains an integral main gate. The pulse train from the main gate is counted by an eight decade counter, two and a half decades of which are discrete i.c.'s and the remainder part of a custom designed l.s.i. m.o.s. i.c.

HF input

The input signal is fed into an overload protected and gain controlled input buffer comprising an r.f. fuse, an active limiting circuit and fast acting p.i.n. diode attenuator. The signal is then amplified and fed via a diode switch to the high speed decade. This signal is also detected, converted into a proportional d.c. voltage and used to control the p.i.n. diode attenuator. The constant amplitude signal thus derived is counted as described above.

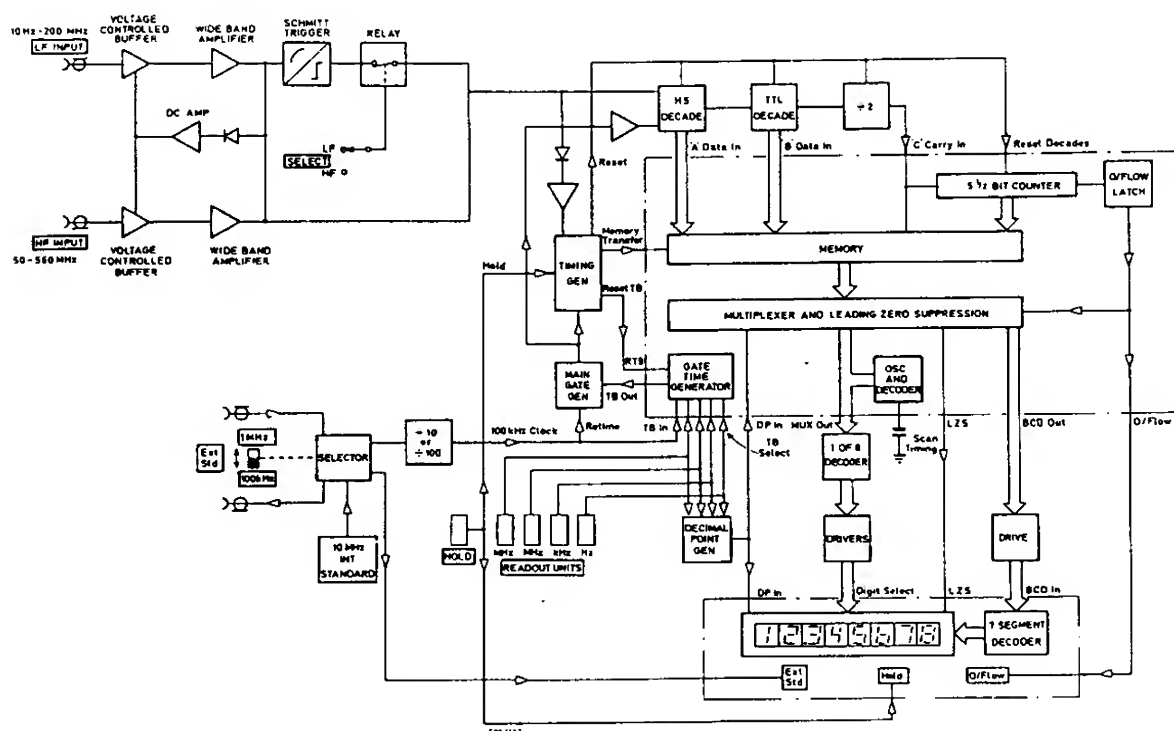


Fig. 3.1 Block diagram

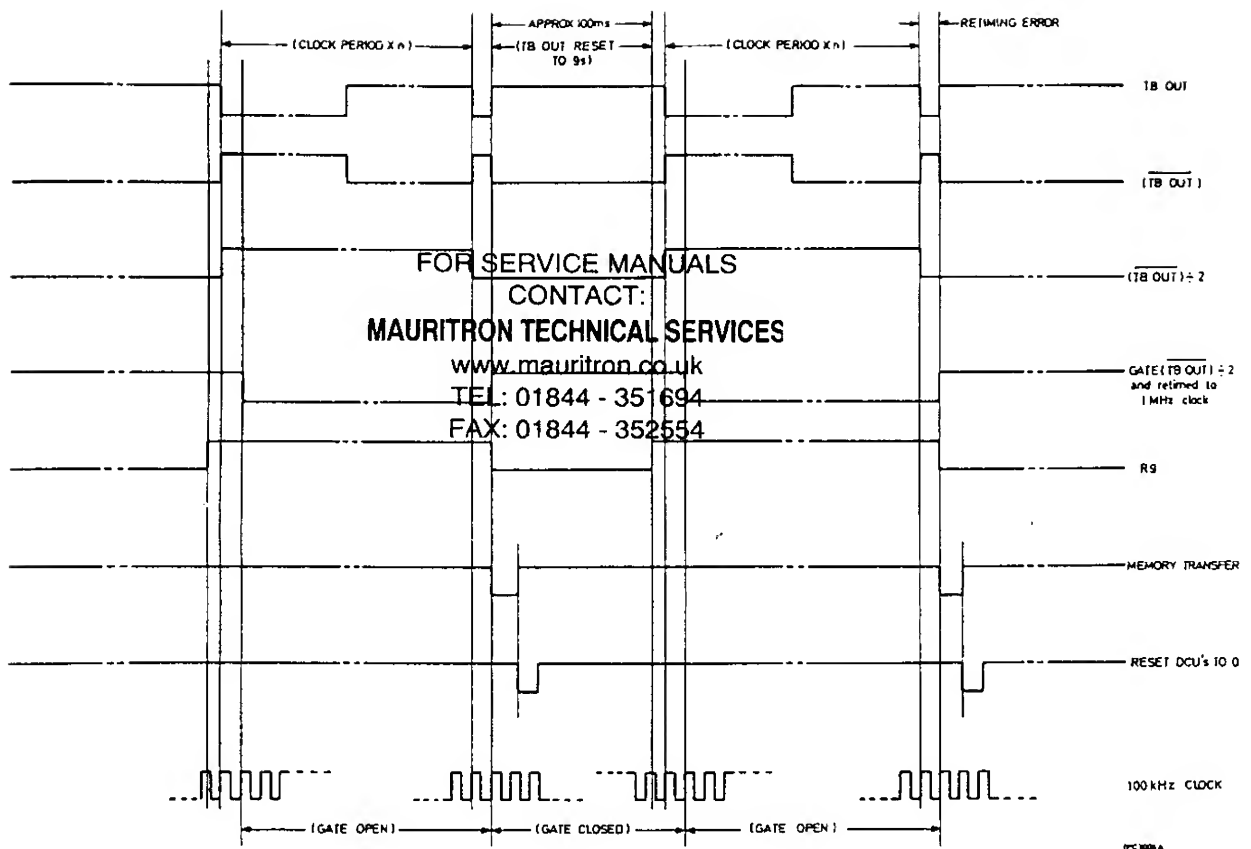


Fig. 3.2 Timing sequence

3.2 CLOCK SELECTION AND GATE GENERATOR

The counter's main reference clock can be generated from an internal 10 MHz crystal oscillator or introduced from an external 1 MHz or 100 kHz source via the EXT STD socket. A signal applied to the EXT STD socket will automatically override the counter's internal standard.

Before being used to generate the gating signal or to retime the main gate the internal 10 MHz signal is divided by 100. This 100 kHz clock is fed into the m.o.s. i.c. and divided down by the selected ratio, the maximum being 10^6 .

The time base output is divided by two and retimed with the original 100 kHz clock signal before being applied to the main gate.

3.3 TIMING GENERATOR

TTL monostable integrated circuits generate a timing sequence which describes the display time, memory transfer and reset times. Waveform diagrams which show the timing sequences are illustrated in Fig. 3.2.

3.4 LOGIC CIRCUIT

A custom designed l.s.i. m.o.s. integrated circuit is the heart of the counter and contains all the digital logic that does not need to run at high currents or speeds.

The i.c. contains a $5\frac{1}{2}$ decade counter with overflow latch and an eight decade memory. Two and a half decades of the memory have a parallel data loading capability to enable the i.c. to be used with higher speed logic. The data from the memories are fed into a multiplexer which is controlled by an on-chip oscillator and 1 of 8 encoder.

A signal for providing leading zero suppression is generated in the i.c. The 40 pin package also contains a time base section comprising a seven decade divider and a 1 of 7 data selector.

3.5 SWITCHING

Front panel controls select HOLD and one of four gate times. The 10 ms, 100 ms, 1 s or 10 s gates describe the display resolution, units and decimal point position.

3.6 DISPLAY BOARD

The display board contains the 7 segment l.e.d. displays and b.c.d. to 7 segment encoder with its associated current limiting resistors. The board requires 1 of n digit drive (where n = number of displays), multiplexed b.c.d. information, a decimal point signal and leading zero suppression signal. Three lamps are mounted on this board indicating HOLD, OVERFLOW and EXTERNAL STANDARD operation.

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4.1 GENERAL

This section is intended as a general guide to the servicing of the instrument. In case of difficulties that cannot be resolved with the aid of this book, or for advice on maintaining the instrument, please write or phone our Service Division or nearest Area Office or Agent. Always mention the type number or serial number of your instrument. (Address on rear cover.)

The only part of the instrument which should need regular attention is the 10 MHz oscillator. This should be periodically checked to ensure that it is operating at the correct frequency, and adjusted to offset any ageing drift that has taken place.

CAUTION Static sensitive components

Components identified with the symbol \triangle on the circuit diagrams and/or parts list are static sensitive devices. The presence of such devices is also indicated in the equipment by orange discs, flags or labels bearing the same symbol. Certain handling precautions must be observed to prevent these components being permanently damaged by static charges or fast surges.

(1) If a printed board containing static sensitive components (as indicated by a warning disc or flag) is removed, it must be temporarily stored in a conductive plastic bag.

(2) If a static sensitive component is to be removed or replaced the following anti-static equipment must be used.

A work bench with an earthed conductive surface.

Metallic tools earthed either permanently or by repeated discharges.

A low-voltage earthed soldering iron.

An earthed wrist strap and a conductive earthed seat cover for the operator, whose outer clothing must not be of man-made fibre.

(3) As a general precaution, avoid touching the leads of a static sensitive component. When handling a new one, leave it in its conducting mount until it is required for use.

4.2 FUSES

The counter is protected by a delay fuse in the line conductor of the mains supply. The instrument should be turned off while the fuse is changed. Access is by means of a screw cap on the rear panel.

The h.f. input circuit is protected by a 0.1 A r.f. fuse in series with SKB. To gain access to this fuse which is located near the front of the function board, switch off the instrument, remove the control board/display board assembly and unscrew the metal screen near the input socket. To change a fuse unsolder it from the printed board and replace it with the adjacent spare one.

4.3 REMOVING COVERS

The cover is retained by two screws at the back of the instrument. These screws also hold the protective clamps and their removal allows the case to be slid backwards over the rear panel. The separation of instrument and case is best achieved with the instrument upside down.

4.4 ACCESS TO POWER SUPPLY

The function board, control board and transformer support chassis are held between the two side frames of the uncased instrument.

Power supply components are below the chassis and access to them can be gained by hinging the chassis forward into a vertical position. This is done by first removing the control board and then removing the two chassis retaining screws on the rear panel and the rear two screws holding the chassis to the side frames. The remaining side frame screws should then be slackened, so that the chassis may hinge about them, and tightened to hold it in a convenient position. No electrical connections need to be removed.

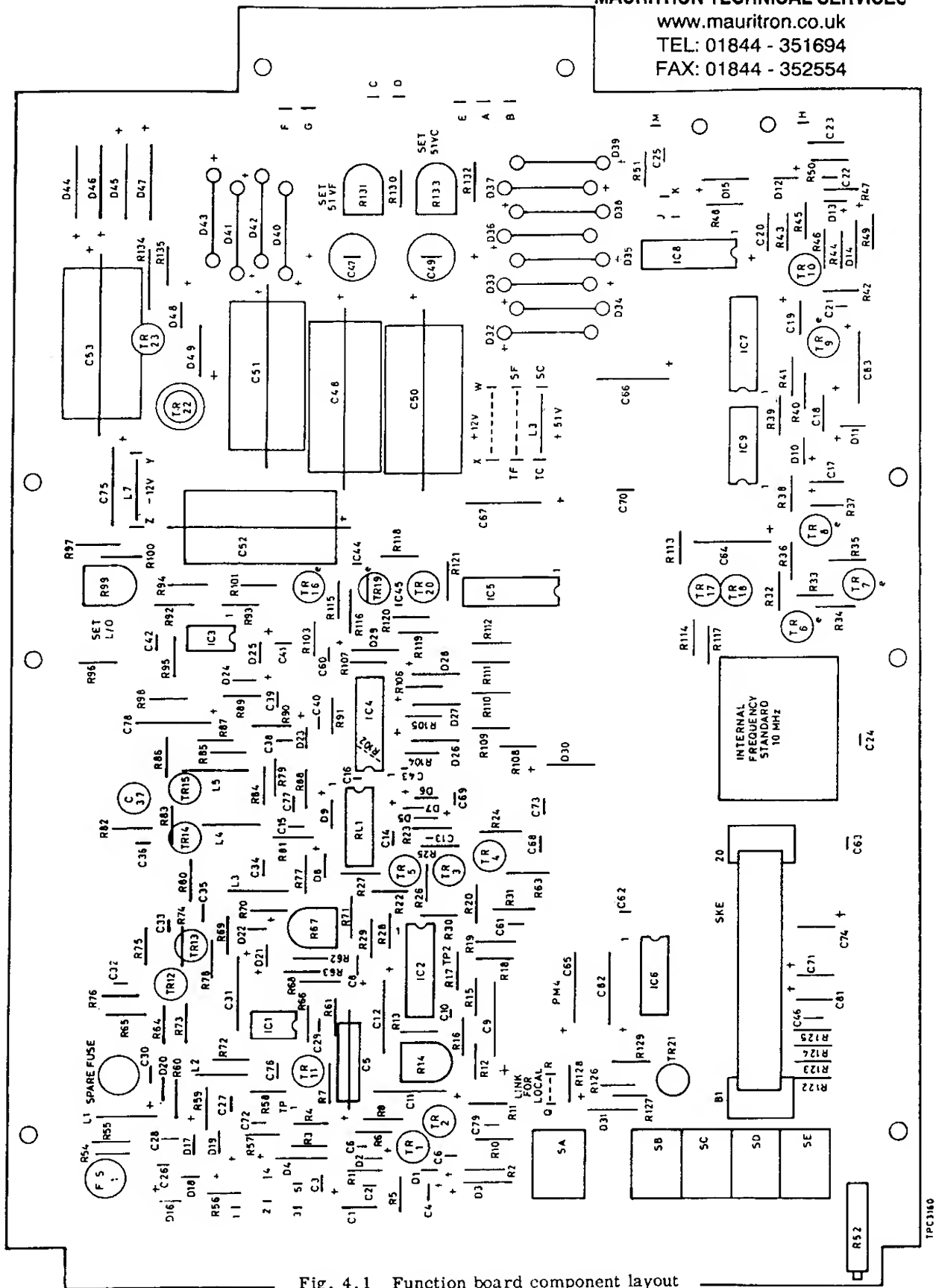


Fig. 4.1 Function board component layout

4.5 ADJUSTMENT OF INTERNAL 10 MHz STANDARD

The accuracy of the internal standard can be checked by comparing it with an accurately known external standard as follows :-

- (1) Connect a known external frequency to the selected input socket. The value of the frequency is unimportant, although higher frequency allows greater discrimination.
- (2) If necessary fine adjustment of the internal standard can be done, without removing the instrument from its case, by means of the ADJ INT STD facility on the front panel.

If the internal standard cannot be set accurately with the ADJ INT STD, coarse adjustment to the oscillator frequency can be carried out by means of a preset variable capacitor (A3C2 or A4C2). Access to this is obtained by removal of the instrument case.

4.6 ACCESS TO CONTROL BOARD AND DISPLAY BOARD

The display board is connected to the control board via a 40 way edge connector at the front of the instrument. The control board itself is fixed

to the top of the instrument and electrically connected to the lower function board via a 20 way double sided link board. When the seven fixing screws have been removed, the control board/display board assembly can be pulled away from the instrument. For servicing purposes, the control board/display board assembly can be fitted into the edge connector on the function board as shown in Fig. 4.2 after removing the link board that normally provides the interconnection. (The front panel need not be removed.) The instrument will still operate in this position.

The display board may be removed from the control board by simply pulling away from the front of the control board.

4.7 ACCESS TO AMPLIFIER BUFFER

The amplifiers are located under a metal screen near the input socket. Should it be necessary to remove this screen the procedure is as follows :-

- (1) Turn off the instrument.
- (2) Remove the control board/display board assembly.
- (3) Remove the retaining screws at the top front end of the input bracket.

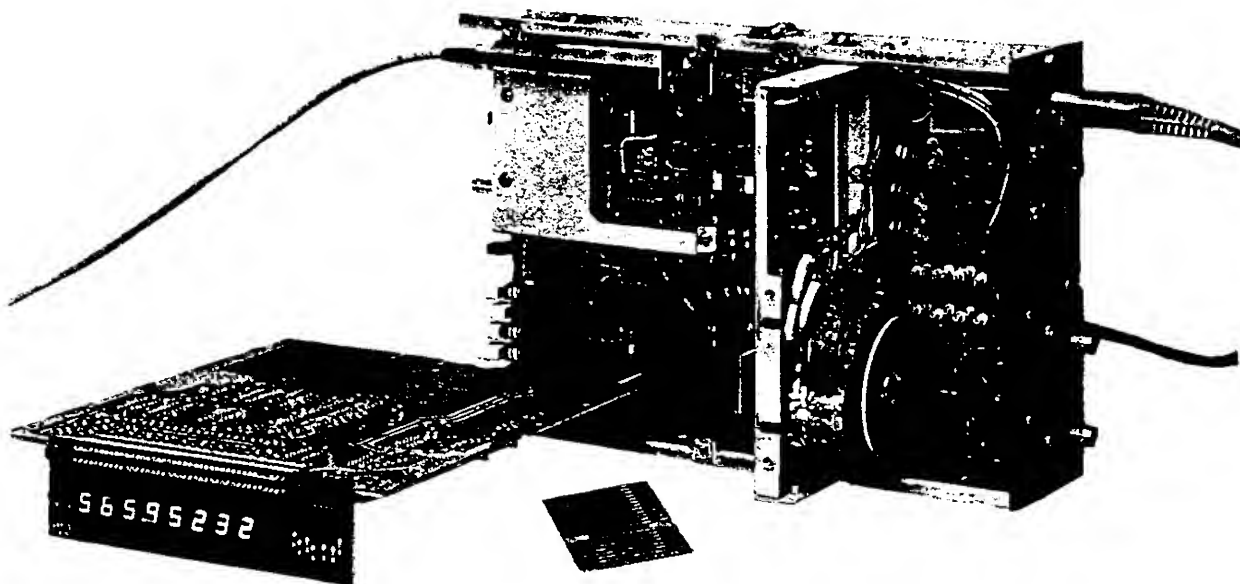


Fig. 4.2 Control board and display board operating in the servicing position

- (4) Turn the instrument upside down and remove the screws on the bottom of the input bracket and screen.
- (5) Replace the control board/display board assembly and switch on the instrument.

4.8 POWER SUPPLY LINKS

Inductors L6 and L7 between tags SC - TC and Y - Z below the mains switch, and the wire links between tags SF - TF and W - X can be removed to isolate the power supply from the counter circuit. Adjustment of the preset variable resistors R131 and R133 which sets 5.1 VF and 5.1 VC should be carried out with these links in position, i.e., with a load on the power supply.

4.9 POWER SUPPLY ADJUSTMENT

If repairs have been made to the power supply the 5.1 V lines should be reset as follows :-

- (1) Connect a digital voltmeter such as the Fluke 8000 A set to d.c. volts, 10 mV resolution, to link TF - SF.
- (2) Adjust R131 until the d.v.m. reads 5.11 V ± 0.1 V.
- (3) Transfer the d.v.m. to link SC - TC and adjust R133 for a reading of 5.11 V ± 0.1 V.

4.10 AMPLIFIER ADJUSTMENT

The response of the h.f. amplifier can be adjusted by C37 on the function board. The measurement technique best used is to apply a swept frequency to the input of the instrument and to pick off the signal appearing at pin 14 of IC4 via an a.c. coupled 100 Ω detector. The response should be set for optimum flatness over the range of the amplifier.

4.11 AGC ADJUSTMENT

Monitor TP1 (at the emitter of TR11 on the function board) with a voltmeter or oscilloscope and set the d.c. potential at this point to be +4 V using R67 on the function board.

4.12 IC4 BIAS ADJUSTMENT

Miscounting when using the l.f. input can be caused by an incorrect d.c. bias at the input (pin 14) of IC4. This bias can be corrected using R27. The mid-point of the signal appearing at this point should correspond to the no-signal d.c. level when the front panel input switch is selecting the h.f. input.

4.13 SET LOCKOUT ADJUSTMENT

A characteristic of IC4 is that with no signal input it will oscillate at a frequency around 300 to 400 MHz. With the h.f. input selected and no signal applied to it, R99 should be set so that the counter just fails to read the oscillating frequency.

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Replaceable parts

Introduction

Each sub-assembly or printed circuit board in this instrument has been allocated a unit identification in the sequence A0 to A11.

The complete component reference carries its unit number as a prefix e.g. A1C1 but for convenience in the text and on circuit diagrams the prefix is not used.

However, when ordering replacements or in correspondence the complete component reference must be quoted.

The components are listed in alphanumerical order of the complete circuit reference and the following abbreviations are used :

FOR SERVICE MANUALS CONTACT:	
MAURITRON TECHNICAL SERVICES	
C : capacitor	www.mauritron.co.uk
Carb : carbon	TEL: 01844 - 351694
Cer : ceramic	FAX: 01844 - 352554
Cerm: cermet	
D : semiconductor diode	
DI : digital indicator	
Elec : electrolytic	
FS : fuse	
IC : integrated circuit	
L : inductor	
Max : maximum	
ME : meter	
Met : metal	
Mic : mica	
Min : minimum value	
Ox : oxide	
PL : plug	
Plas : plastic dielectric	
R : resistor	
REG : regulator	
S : switch	
SK : socket	
T : transformer	
Tant : tantalum	
TP : terminal	
TR : transistor	
Var : variable	
WW : wirewound	
XL : crystal	
† : value selected during test; nominal value listed	

Ø	: feed-through component
W	: watts at 70°C
⚠	: static sensitive component

NOTE : One or more of the components fitted in this instrument may differ from those listed in this chapter for any of the following reasons :

- (a) Components indicated by a † have their value selected during test to achieve particular performance limits.
- (b) Owing to supply difficulties, components of different value or type may be substituted provided the overall performance of the instrument is maintained.
- (c) As part of a policy of continuous development components may be changed in value or type to obtain detail improvements in performance.

When there is a difference between the component fitted and the one listed, always use as a replacement the same type and value as found in the instrument.

Ordering

When ordering replacements, address the order to our Service Division (address on rear cover) or nearest agent and specify the following for each component required.

- (1) Type* and serial number of instrument.
- (2) Complete circuit reference.
- (3) Description.
- (4) MI code number.

* As given on the serial number label at the rear of the instrument; if this is superseded by a number label, quote the model number instead of the type number.

<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>	<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>
<u>Unit A0 : Overall assembly</u>			C8	Tant 4.7 μ F 20% 10V	26486-554G
FS1	250mA	23411-055P	C9	Tant 47 μ F 20% 6V	26486-593D
	Fuse holder	23416-191C	C10	† Cer 10pF 5% 50V	26343-465H
	Cover for fuse holder	37575-121B	C11	Tant 47 μ F 20% 6V	26486-593D
			C12	Tant 47 μ F 20% 6V	26486-593D
PLA	Mains plug/filter assembly	23423-150L	C13	Cer 22pF 5% 50V	26343-469N
	Cover for mains plug/filter	37590-150P	C14	Cer 0.047 μ F -20+80% 25V	26383-017U
			C15	Cer 0.001 μ F -20+80% 500V	26383-242P
REG1	Voltage regulator (5V) 7805	28461-707G	C16	Cer 47pF 5% 50V	26343-473L
REG2	Voltage regulator (5V) 7805	28461-707G	C17	Tant 4.7 μ F 20% 10V	26486-554G
REG3	Voltage regulator (12V) 7812	28461-708V	C18	Tant 4.7 μ F 20% 10V	26486-554G
			C19	Cer 0.001 μ F -20+80% 500V	26383-242P
SA	SUPPLY ON/OFF	23462-353A	C20	Tant 4.7 μ F 20% 10V	26486-554G
	Cover for SA	37590-177D	C21	Cer 0.01 μ F -20+80% 100V	26383-055L
	Extension spindle for SA	37590-143S	C22	Cer 22pF 2.5pF 750V	26324-715T
SB	230V/115V	23467-155G	C23	Plas 0.1 μ F 20% 250V	26582-799N
	Cover (red) for SB	37573-145C	C24	Cer 0.047 μ F -20+80% 25V	26383-017U
	Locking plate for SB	34444-116Y	C25	Cer 0.047 μ F -20+80% 25V	26383-017U
			C26	Cer 0.001 μ F -20+80% 500V	26383-242P
T1	Mains transformer	43490-035R	C27	Cer 0.047 μ F -20+80% 25V	26383-017U
	* Rubber cushion pad for T1	37490-263X	C28	Cer 0.001 μ F -20+80% 500V	26383-242P
			C29	Cer 0.01 μ F -20+80% 100V	26383-055L
			C30	Cer 0.001 μ F -20+80% 500V	26383-242P
	* Replace pad when replacing T1.		C31	Tant 22 μ F 20% 15V	26486-583L
			C32	Cer 0.047 μ F -20+80% 25V	26383-017U
			C33	Cer 22pF 2.5pF 750V	26324-715T
			C34	Cer 22pF 2.5pF 750V	26324-715T
			C35	Cer 22pF 2.5pF 750V	26324-715T
			C36	Cer 10pF \pm 0.25pF 750V	26324-709S
			C37	Var cer 4.5-15pF	26847-115H
			C38	Cer 0.001 μ F -20+80% 500V	26383-242P
			C39	Cer 22pF \pm 2.5pF 750V	26324-715T
			C40	Cer 0.001 μ F -20+80% 500V	26383-242P
			C41	Cer 0.047 μ F -20+80% 25V	26383-017U
<u>Unit A1 : Function board</u>					
	Complete board	44827-500U			
C1	Plas 0.1 μ F 20% 250V	26582-799N			
C2	Cer 22pF 2.5pF 750V	26324-715T			
C3	Tant 0.47 μ F 20% 35V	26486-207L			
C4	Tant 0.47 μ F 20% 35V	26486-207L			
C5	Elec 100 μ F -20+100% 25V	26415-813U			
C6	Cer 0.047 μ F -20+80% 25V	26383-017U			
C7	Cer 0.047 μ F -20+80% 25V	26383-017U			

For symbols and abbreviations see introduction to this chapter

<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>	<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>
C42	Cer 0.01 μ F -20+80% 100V	26383-055L	C82	Tant 22 μ F 20% 15V	26486-583L
C43	Cer 47pF 5% 50V	26343-473L	C83	Tant 22 μ F 20% 15V	26486-583L
C44	Cer 33pF 5% 50V	26343-471Y	C84	Cer 2.2 μ F 5% 50V	26343-457R
C45	Cer 330pF 2% 50V	26343-483D			
C46	Cer 0.047 μ F -20+80% 25V	26383-017U	D1	1N4148	28336-676J
C47	Elec 470 μ F -20+100% 16V	26423-262J	D2	1N4148	28336-676J
C48	Elec 1000 μ F -20+100% 16V	26415-825W	D3	Z5B10.0	28371-843E
C49	Elec 470 μ F -20+100% 16V	26423-262J	D4	Z5B10.0	28371-843E
C50	Elec 1000 μ F -20+100% 16V	26415-825W	D5	1N4148	28336-676J
C51	Elec 470 μ F -20+100% 40V	26415-823V	D6	1N4148	28336-676J
C52	Elec 470 μ F -20+100% 40V	26415-823V	D7	1N4148	28336-676J
C53	Elec 470 μ F -20+100% 40V	26415-823V	D8	1N4148	28336-676J
			D9	1N4148	28336-676J
C60	Cer 0.047 μ F -20+80% 25V	26383-017U	D10	1N4148	28336-676J
C61	Cer 0.047 μ F -20+80% 25V	26383-017U	D11	1N4148	28336-676J
C62	Cer 0.047 μ F -20+80% 25V	26383-017U	D12	1N4148	28336-676J
C63	Cer 0.047 μ F -20+80% 25V	26383-017U	D13	1N4148	28336-676J
C64	Tant 47 μ F 20% 6V	26486-593D	D14	Z5B3.0	28371-203G
C65	Tant 47 μ F 20% 6V	26486-593D	D15	Z5B3.0	28371-203G
C66	Tant 47 μ F 20% 6V	26486-593D	D16	MBD102	28349-004A
C67	Tant 47 μ F 20% 6V	26486-593D	D17	MBD102	28349-004A
C68	Cer 0.047 μ F -20+80% 25V	26383-017U	D18	MBD102	28349-004A
C69	Cer 0.047 μ F -20+80% 25V	26383-017U	D19	MBD102	28349-004A
C70	Cer 0.047 μ F -20+80% 25V	26383-017U	D20	5082-3080	28383-999X
C71	Tant 4.7 μ F 20% 10V	26486-554G	D21	MBD102	28349-004A
C72	Cer 0.047 μ F -20+80% 25V	26383-017U	D22	MBD102	28349-004A
C73	Cer 0.047 μ F -20+80% 25V	26383-017U	D23	1N4148	28336-676J
C74	Tant 2.2 μ F 20% 20V	26486-540K	D24	MBD102	28349-004A
C75	Tant 22 μ F 20% 15V	26486-583L	D25	MBD102	28349-004A
C76	Cer 0.047 μ F -20+80% 25V	26383-017U	D26	Z5B4.7	28371-373V
C77	Cer 0.047 μ F -20+80% 25V	26383-017U	D27	Z5B4.7	28371-373V
C78	Tant 22 μ F 20% 15V	26486-583L	D28	Z5B4.7	28371-373V
C79	Cer 0.047 μ F -20+80% 25V	26383-017U	D29	Z5B4.7	28371-373V
			D30	Z5B5.1	28371-403N
C81	Tant 2.2 μ F 20% 20V	26486-540K	D31	Z5B3.6	28371-223Z

For symbols and abbreviations see Introduction to this chapter

<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>	<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>
D32	1N4004	28357-028K	L5	Choke 1 μ H	23642-549L
D33	1N4004	28357-028K	L6	Choke 1 μ H	23642-549L
D34	1N4004	28357-028K	L7	Choke 10 μ H	23642-555G
D35	1N4004	28357-028K			
D36	1N4004	28357-028K	R1	Carb 1M Ω 5% 1/8W	24311-945Y
D37	1N4004	28357-028K	R2	Met film 4.7k Ω 2% $\frac{1}{4}$ W	24773-289W
D38	1N4004	28357-028K	R3	Met film 4.7k Ω 2% $\frac{1}{4}$ W	24773-289W
D39	1N4004	28357-028K	R4	Met film 10k Ω 2% $\frac{1}{4}$ W	24773-297M
D40	1N4004	28357-028K	R5	Carb 10M Ω 10% 1/8W	24321-885W
D41	1N4004	28357-028K	R6	Met film 220k Ω 2% $\frac{1}{4}$ W	24773-329T
D42	1N4004	28357-028K	R7	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C
D43	1N4004	28357-028K	R8	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C
D44	1N4004	28357-028K	R9	Met film 51 Ω 2% $\frac{1}{4}$ W	24773-242Z
D45	1N4004	28357-028K	R10	Met film 33 Ω 2% $\frac{1}{4}$ W	24773-237K
D46	1N4004	28357-028K	R11	Met film 1k Ω 2% $\frac{1}{4}$ W	24773-273A
D47	1N4004	28357-028K	R12	Met film 2.2 Ω 2% $\frac{1}{4}$ W	24773-209E
D48	1N4148	28336-676J	R13	Met film 1k Ω 2% $\frac{1}{4}$ W	24773-273A
D49	Z5B13.0	28372-213U	R14	Var cer 10k Ω 10% $\frac{1}{2}$ W	25711-543D
D50	1N825	28371-494Z	R15	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C
FS1	RF Littel fuse 0.1A 125V	23411-801L	R16	Met film 68 Ω 2% $\frac{1}{4}$ W	24773-269K
IC1	μ A741	28461-304T	R17	Met film 15k Ω 2% $\frac{1}{4}$ W	24773-301P
IC2	MC1692L	28469-170N	R18	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C
IC3	μ A741	28461-304T	R19	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C
IC4	SP8635SB	28464-012G	R20	Met film 2.2 Ω 2% $\frac{1}{4}$ W	24773-209E
IC5	82S90	28464-010J	R21	Met film 82 Ω 2% $\frac{1}{4}$ W	24773-247N
IC6	7472	28462-003L	R22	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
IC7	74132	28469-202E	R23	Met film 100 Ω 2% $\frac{1}{4}$ W	24773-249J
IC8	7490	28464-002E	R24	Met film 560 Ω 2% $\frac{1}{4}$ W	24773-267R
IC9	7490	28464-002E	R25	Met film 220 Ω 2% $\frac{1}{4}$ W	24773-257W
			R26	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C
			R27	† Met film 820 Ω 2% $\frac{1}{4}$ W	24773-271B
L1	Choke 33 μ H	23642-558W	R28	Met film 200 Ω 2% $\frac{1}{4}$ W	24773-256S
L2	Choke 33 μ H	23642-558W	R29	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C
L3	Choke 0.22 μ H	23642-545E	R30	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
L4	Choke 1 μ H	23642-549L	R31	Met film 220 Ω 2% $\frac{1}{4}$ W	24773-257W

For symbols and abbreviations see introduction to this chapter

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<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>	<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>
R32	Met film 1k Ω 2% $\frac{1}{4}$ W	24773-273A	R68	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R
R33	Met film 1k Ω 2% $\frac{1}{4}$ W	24773-273A	R69	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R
R34	Met film 10k Ω 2% $\frac{1}{4}$ W	24773-297M	R70	Met film 10k Ω 2% $\frac{1}{4}$ W	24773-297M
R35	Met film 10k Ω 2% $\frac{1}{4}$ W	24773-297M	R71	Met film 47 Ω 2% $\frac{1}{4}$ W	24773-241A
R36	Met film 1k Ω 2% $\frac{1}{4}$ W	24773-273A	R72	Met film 4.7k Ω 2% $\frac{1}{4}$ W	24773-289W
R37	Met film 4.7k Ω 2% $\frac{1}{4}$ W	24773-289W	R73	Met film 1.8k Ω 2% $\frac{1}{4}$ W	24773-279N
R38	Met film 4.7k Ω 2% $\frac{1}{4}$ W	24773-289W	R74	Met film 4.7k Ω 2% $\frac{1}{4}$ W	24773-289W
R39	Met film 750 Ω 2% $\frac{1}{4}$ W	24773-270R	R75	Met film 100 Ω 2% $\frac{1}{4}$ W	24773-249J
R40	Met film 47 Ω 2% $\frac{1}{4}$ W	24773-241A	R76	Met film 100 Ω 2% $\frac{1}{4}$ W	24773-249J
R41	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R	R77	Met film 390 Ω 2% $\frac{1}{4}$ W	24773-263P
R42	Met film 750 Ω 2% $\frac{1}{4}$ W	24773-270R	R78	Met film 1k Ω 2% $\frac{1}{4}$ W	24773-273A
R43	Met film 47 Ω 2% $\frac{1}{4}$ W	24773-241A	R79	Met film 100 Ω 2% $\frac{1}{4}$ W	24773-249J
R44	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R	R80	Met film 22 Ω 2% $\frac{1}{4}$ W	24773-233M
R45	Met film 33 Ω 2% $\frac{1}{4}$ W	24773-237K	R81	Met film 1.8k Ω 2% $\frac{1}{4}$ W	24773-279N
R46	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R	R82	Met film 15 Ω 2% $\frac{1}{4}$ W	24773-229X
R47	Carb 10M Ω 10% 1/8W	24321-885W	R83	Met film 620 Ω 2% $\frac{1}{4}$ W	24773-268B
R48	Met film 4.7k Ω 2% $\frac{1}{4}$ W	24773-289W	R84	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C
R49	Met film 4.7k Ω 2% $\frac{1}{4}$ W	24773-289W	R85	Met film 2.2 Ω 2% $\frac{1}{4}$ W	24773-209E
R50	Carb 1M Ω 5% 1/8W	24311-945Y	R86	Met film 68 Ω 2% $\frac{1}{4}$ W	24773-245U
R51	Met film 1k Ω 2% $\frac{1}{4}$ W	24773-273A	R87	Met film 1k Ω 2% $\frac{1}{4}$ W	24773-273A
R52	Var cer 10k Ω 10% 0.3W	25748-507X	R88	Met film 560 Ω 2% $\frac{1}{4}$ W	24773-267R
			R89	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C
R54	Met film 220 Ω 2% $\frac{1}{4}$ W	24773-257W	R90	Met film 560 Ω 2% $\frac{1}{4}$ W	24773-267R
R55	Met film 220 Ω 2% $\frac{1}{4}$ W	24773-257W	R91	Met film 56k Ω 2% $\frac{1}{4}$ W	24773-315U
R56	Met film 1.2k Ω 2% $\frac{1}{4}$ W	24773-275H	R92	Met film 4.7k Ω 2% $\frac{1}{4}$ W	24773-289W
R57	Met film 1.2k Ω 2% $\frac{1}{4}$ W	24773-275H	R93	Met film 100k Ω 2% $\frac{1}{4}$ W	24773-321L
R58	Met film 390 Ω 2% $\frac{1}{4}$ W	24773-263P	R94	Met film 100k Ω 2% $\frac{1}{4}$ W	24773-321L
R59	Met film 220 Ω 2% $\frac{1}{4}$ W	24773-257W	R95	Carb 2.2M Ω 10% 1/8W	24321-877J
R60	Met film 2k Ω 2% $\frac{1}{4}$ W	24773-280U	R96	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C
R61	Carb 1M Ω 5% 1/8W	24311-945Y	R97	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C
R62	Met film 100k Ω 2% $\frac{1}{4}$ W	24773-321L	R98	Met film 15k Ω 2% $\frac{1}{4}$ W	24773-301P
R63	Met film 100k Ω 2% $\frac{1}{4}$ W	24773-321L	R99	Var cer 2.2k Ω 10% $\frac{1}{2}$ W	25711-547M
R64	Met film 10 Ω 2% $\frac{1}{4}$ W	24773-225W	R100	Met film 15k Ω 2% $\frac{1}{4}$ W	24773-301P
R65	Met film 100 Ω 2% $\frac{1}{4}$ W	24773-249J	R101	Met film 10k Ω 2% $\frac{1}{4}$ W	24773-297M
R66	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R			
R67	Var cer 10k Ω 10% $\frac{1}{2}$ W	25711-543D	R103	Met film 1k Ω 2% $\frac{1}{4}$ W	24773-273A

For symbols and abbreviations see introduction to this chapter

<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>	<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>
R104	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F	SB	Push-button switch assembly 44338-054N	
R105	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F	SC		
R106	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F	SD		
			SE		
R107	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F	SF	SELECT	23467-155G
R108	Met film 4.7k Ω 2% $\frac{1}{4}$ W	24773-289W	SG	EXT STD	23467-155G
R109	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R			
R110	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R	SKA	LF INPUT 50 Ω BNC receptacle	23443-406R
R111	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R			
R112	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R	SKB	HF INPUT 50 Ω BNC receptacle	23443-406R
R113	Met film 47 Ω 2% $\frac{1}{4}$ W	24773-241A			
R114	Met film 10k Ω 2% $\frac{1}{4}$ W	24773-297M	SKC	EXT STD 50 Ω BNC receptacle	23443-446H
R115	Met film 680 Ω 2% $\frac{1}{4}$ W	24773-269K			
R116	Met film 10 Ω 2% $\frac{1}{4}$ W	24773-225W	SKD	INT STD 50 Ω BNC receptacle	23443-446H
R117	Met film 1k Ω 2% $\frac{1}{4}$ W	24773-273A			
R118	Met film 47 Ω 2% $\frac{1}{4}$ W	24773-241A	SKE	Edge connector 20-way	23435-056W
R119	Met film 82 Ω 2% $\frac{1}{4}$ W	24773-247N	TR1	40673 Δ	28459-010V
R120	Met film 560 Ω 2% $\frac{1}{4}$ W	24773-267R	TR2	2N5179	28451-697Y
R121	Met film 560 Ω 2% $\frac{1}{4}$ W	24773-267R	TR3	2N5179	28451-697Y
R122	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C	TR4	2N5179	28451-697Y
R123	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C	TR5	2N5179	28451-697Y
R124	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C	TR6	BC238B	28452-781A
R125	Met film 510 2% $\frac{1}{4}$ W	24773-266C	TR7	BC238B	28452-781A
R126	Met film 200 Ω 2% $\frac{1}{4}$ W	24773-256S	TR8	BC238B	28452-781A
R127	Met film 33 Ω 2% $\frac{1}{4}$ W	24773-273K	TR9	2N5179	28451-697Y
R128	Met film 200 Ω 2% $\frac{1}{4}$ W	24773-256S	TR10	40673 Δ	28459-010V
R129	Met film 510 Ω 2% $\frac{1}{4}$ W	24773-266C	TR11	BSX20	28452-197H
R130	Met film 10k Ω 2% $\frac{1}{4}$ W	24773-297M	TR12	BFR90	28452-167U
R131	Var cer 100 Ω 10% $\frac{1}{2}$ W	25711-545P	TR13	BFR90	28452-167U
R132	Met film 10k Ω 2% $\frac{1}{4}$ W	24773-297M	TR14	BFR90	28452-167U
R133	Var cer 100 Ω 10% $\frac{1}{2}$ W	25711-545P	TR15	BFR90	28452-167U
R134	WW 100 Ω 5% 1 $\frac{1}{2}$ W	25123-050L	TR16	BC238B	28452-781A
R135	Met film 1.8k Ω 2% $\frac{1}{4}$ W	24773-279N	TR17	BC238B	28452-781A
R136	Met film 750 Ω 2% $\frac{1}{4}$ W	24773-270R	TR18	BC238B	28452-781A
			TR19	MPS-L08	28431-767E
RL1	Reed relay	23486-445S	TR20	2N5179	28451-697Y
SA	HOLD	44338-055L	TR21	BC173C	28452-771P

For symbols and abbreviations see introduction to this chapter

<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>	<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>
TR22	MM4001	28438-436V	IC7	74145	28465-018E
	Heat sink for TR22	28488-448H	IC8	SN7400	28466-321L
TR23	BC308B	28433-455R			
<u>Unit A2 : Control board</u>			R1	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
	Complete board	44827-498J	R2	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
C1	Cer 0.001 μ F -20+80% 500V	26383-242P	R3	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
C2	Cer 0.001 μ F -20+80% 500V	26383-242P	R4	Met film 560 Ω 2% $\frac{1}{4}$ W	24773-267R
C3	Tant 22 μ F 20% 15V	26486-583L	R5	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R
C4	Cer 0.001 μ F -20+80% 500V	26383-242P	R6	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R
C5	Cer 0.001 μ F -20+80% 500V	26383-242P	R7	Met film 22k Ω 2% $\frac{1}{4}$ W	24773-305R
C6	Cer 0.001 μ F -20+80% 500V	26383-242P	R8	Met film 1k Ω 2% $\frac{1}{4}$ W	24773-273A
C7	Cer 0.001 μ F -20+80% 500V	26383-242P	R9	Met film 47 Ω 2% $\frac{1}{4}$ W	24773-241A
C8	Cer 0.001 μ F -20+80% 500V	26383-242P	R10	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
C9	Cer 0.001 μ F -20+80% 500V	26383-242P	R11	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
C10	Cer 0.001 μ F -20+80% 500V	26383-242P	R12	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
C11	Cer 0.001 μ F -20+80% 500V	26383-242P	R13	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
C12	Cer 0.01 μ F -20+80% 100V	26383-055L	R14	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
C13	Elec 220 μ F -20+100% 10V	26415-817J	R15	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
C14	Tant 6.8 μ F 20% 6V	26486-560W	R16	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
C15	Tant 6.8 μ F 20% 6V	26486-560W	R17	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
C16	Tant 47 μ F 20% 6V	26486-593D	R18	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
C17	Tant 6.8 μ F 20% 6V	26486-560W	R19	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
C18	Cer 0.047 μ F -20+80% 25V	26383-017U	R20	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
C19	Cer 0.047 μ F -20+80% 25V	26383-017U	R21	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
C20	Cer 0.047 μ F -20+80% 25V	26383-017U	R22	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
C21	Cer 0.047 μ F -20+80% 25V	26383-017U	R23	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
C22	Cer 0.047 μ F -20+80% 25V	26383-017U	R24	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
IC1	7474	28462-002N	R25	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
IC2	74123	28468-302D	R26	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
IC3	74123	28468-302D	R27	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
IC4	SN7400	28460-321L	R28	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
IC5	7403A	28466-322J	R29	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
IC6	MA150A \triangle	28469-379V	R30	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
	Socket for IC6, 40 pin DIL	28488-047F	R31	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F
			R32	Met film 330 Ω 2% $\frac{1}{4}$ W	24773-261D
			R33	Met film 3.3k Ω 2% $\frac{1}{4}$ W	24773-285F

For symbols and abbreviations see introduction to this chapter

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Circuit reference	Description	M.I. code	Circuit reference	Description	M.I. code
R34	Met film 330Ω 2% ¼W	24773-261D	LP1	LED, red, FLV140	28624-109M
R35	Met film 4.7kΩ 2% ¼W	24773-289W	LP2	LED, red, FLV140	28624-109M
R36	Met film 4.7kΩ 2% ¼W	24773-289W	LP3	LED, red, FLV140	28624-109M
R37	Met film 4.7kΩ 2% ¼W	24773-289W	LP4	LED, red, FLV140	28624-109M
SKA	Edge connector 2 x 20 way	23435-056W	R1	Met film 56Ω 2% ¼W	24773-243H
			R2	Met film 56Ω 2% ¼W	24773-243H
TR1	BC238	28452-781A	R3	Met film 56Ω 2% ¼W	24773-243H
TR2	BC308	28433-455R	R4	Met film 56Ω 2% ¼W	24773-243H
TR3	BC238	28452-781A	R5	Met film 56Ω 2% ¼W	24773-243H
TR4	BC238	28452-781A	R6	Met film 56Ω 2% ¼W	24773-243H
TR5	BC238	28452-781A	R7	Met film 56Ω 2% ¼W	24773-243H
TR6	BC238	28452-781A	SKA	Edge connector (40 way)	23435-073Z
TR7	BC238	28452-781A			
TR8	2N5448	28433-838Z	<u>Unit A4 : Interconnecting board</u>		
TR9	2N5448	28433-838Z		Complete board	44827-637L
TR10	2N5448	28433-838Z	R1	Met film 1kΩ 2% ¼W	24773-243H
TR11	2N5448	28433-838Z	R2	Met film 10kΩ 2% ¼W	24773-297M
TR12	2N5448	28433-838Z	R3	Met film 10kΩ 2% ¼W	24773-297M
TR13	2N5448	28433-838Z	R4	Met film 10kΩ 2% ¼W	24773-297M
TR14	2N5448	28433-838Z	R5	Met film 10kΩ 2% ¼W	24773-297M
TR15	2N5448	28433-838Z	<u>Unit A10 : 10 MHz oscillator board</u>		
<u>Unit A3 : Display board</u>				Complete board	44827-563E
	Complete board	44827-636N	C1	Cer 22pF 5% 50V	26343-469N
C1	Cer 0.047μF -20+80% 25V	26383-017U	C2	Var cer 4.5pF - 15pF	26847-115H
			C3	Cer 100pF 2% 50V	26343-477V
DI 1	7 segment display, 3620	28624-206W	C4	Cer 220pF 2% 50V	26343-481S
DI 2	7 segment display, 3620	28624-206W	C5	Cer 0.01μF -20+80% 100V	26383-055L
DI 3	7 segment display, 3620	28624-206W	C6	Cer 0.01μF -20+80% 100V	26383-055L
DI 4	7 segment display, 3620	28624-206W	D1	BB142	28381-097W
DI 5	7 segment display, 3620	28624-206W			
DI 6	7 segment display, 3620	28624-206W	R1	Met film 47kΩ 2% ¼W	24773-313H
DI 7	7 segment display, 3620	28624-206W	R2	Met film 47kΩ 2% ¼W	24773-313H
DI 8	7 segment display, 3620	28624-206W	R3	Met film 2.2kΩ 2% ¼W	24773-281Y

For symbols and abbreviations see introduction to this chapter

<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>	<i>Circuit reference</i>	<i>Description</i>	<i>M.I. code</i>
R4	Met film 2.2k Ω 2% $\frac{1}{4}$ W	24773-281Y	R14	Met film 100k Ω 2% $\frac{1}{4}$ W	24773-321L
R5	Met film 68k Ω 2% $\frac{1}{4}$ W	24773-317N			
R6	Met film 680 Ω 2% $\frac{1}{4}$ W	24773-269K	TR1	BC308	28433-455R
R7	Met film 100k Ω 2% $\frac{1}{4}$ W	24773-321L	TR2	2N4918	28434-896Y
			TR3	BC238B	28452-780K
TR1	BC238B	28452-781A	TR4	BC173C	28452-771P
TR2	BC238B	28452-781A			
XL1	10MHz AT cut	28312-047U	XL1	10MHz	28312-043A
<u>Unit A11 : 10 MHz HS oscillator board</u>			<u>Miscellaneous mechanical parts</u>		
	Complete board	44990-195Z	Wrap-round case		35901-943N
C1	Cer 0.0047 μ F -20+80 Ω 100V	26383-321K	Case base plate (less handle assembly)		35901-942Y
C2	Var cer 6pF - 22pF	26847-093S	Aperture plate for rear panel		35901-572V
C3	Cer 22pF 5% 50V	26343-469N	Edging surround for case (1 of 2)		41700-179R
C4	Cer 220pF 2% 50V	26343-481S	Tilt handle		37587-925L
C5	Cer 220pF 2% 50V	26343-481S	Handle attachment		37588-110B
C6	Cer 0.0047 μ F -20+80% 100V	26383-321K	Case foot (1 of 2)		22315-663B
C7	Cer 0.0047 μ F -20+80% 100V	26383-321K	Earthing contact on side frame (1 of 2)		31559-005X
D1	BB142	28381-097W	Buttress moulding, red, supporting display board (1 of 2)		37590-141G
IC1	μ A741C	28461-313B			
			<u>Accessories</u>		
R1	Met film 27k Ω 2% $\frac{1}{4}$ W	24773-307K	Mains lead, with straight 3-way socket		43123-076Y
R2	Met film 27k Ω 2% $\frac{1}{4}$ W	24773-307K			
R3	Met film 2.2k Ω 2% $\frac{1}{4}$ W	24773-281Y	Mains lead, with angled 3-way socket		43129-163L
R4	Met film 2.2k Ω 2% $\frac{1}{4}$ W	24773-281Y			
R5	Thermistor 220k Ω 20% 25 $^{\circ}$ C	25685-242W	Coaxial lead, with BNC plugs		43126-013W
R6	Met film 270 Ω 2% $\frac{1}{4}$ W	24773-259T	Stowage lid for front panel, complete with clips		41690-158L
R7	Met film 1.5 Ω 2% $\frac{1}{4}$ W	24773-205K	Retaining cover for stowage lid		35901-684M
R8	Met film 47k Ω 2% $\frac{1}{4}$ W	24773-307K	Fixing stud for cover (1 of 2)		21186-362J
R9	Met film 47k Ω 2% $\frac{1}{4}$ W	24773-307K	Rubber washer for fixing stud (1 of 2)		21186-362J
R10	Met film 2.2k Ω 2% $\frac{1}{4}$ W	24773-281Y			
R11	Met film 2.2k Ω 2% $\frac{1}{4}$ W	24773-281Y	Rear stand		35901-686R
R12	Met film 68k Ω 2% $\frac{1}{4}$ W	24773-313H	Hand strap		22315-578S
R13	Met film 680 Ω 2% $\frac{1}{4}$ W	24773-269K	Shoulder strap		22315-577V

For symbols and abbreviations see introduction to this chapter

CIRCUIT NOTES**1. COMPONENT VALUES**

Resistors : No suffix = ohms, k = kilohms, M = megohms.

Capacitors : No suffix = microfarads, p = picofarads.

Inductors : No suffix = henries, m = millihenries, μ = microhenries.


SIC : value selected during test; nominal value shown.

2. VOLTAGES

Voltages are d.c. and relative to chassis unless otherwise indicated. Measured with 20 k Ω /V meter.

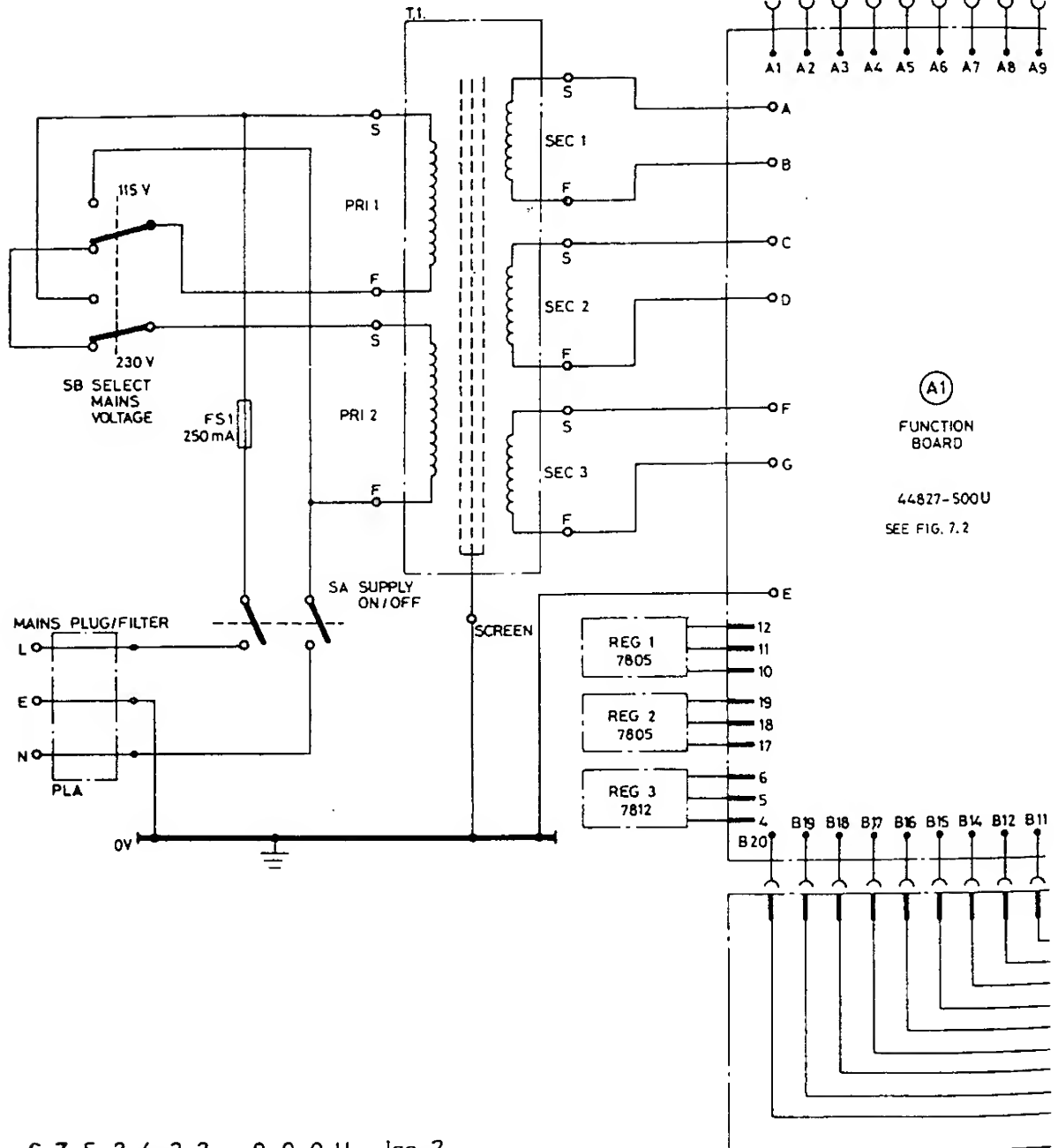
3. SYMBOLS

Generally in accordance with BS 3939.

 see CAUTION notes in Sects. 2.2 and 4.1.

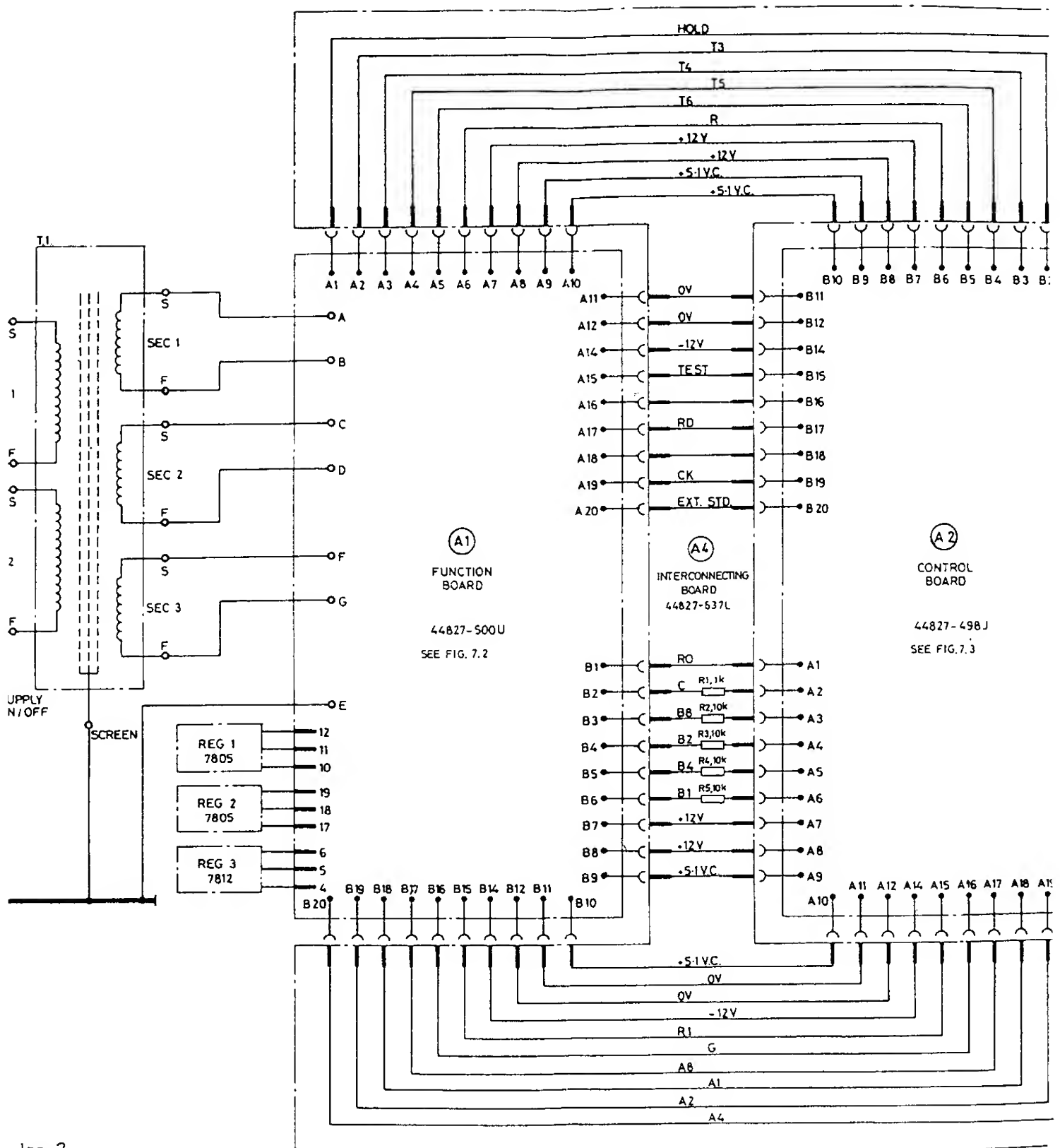
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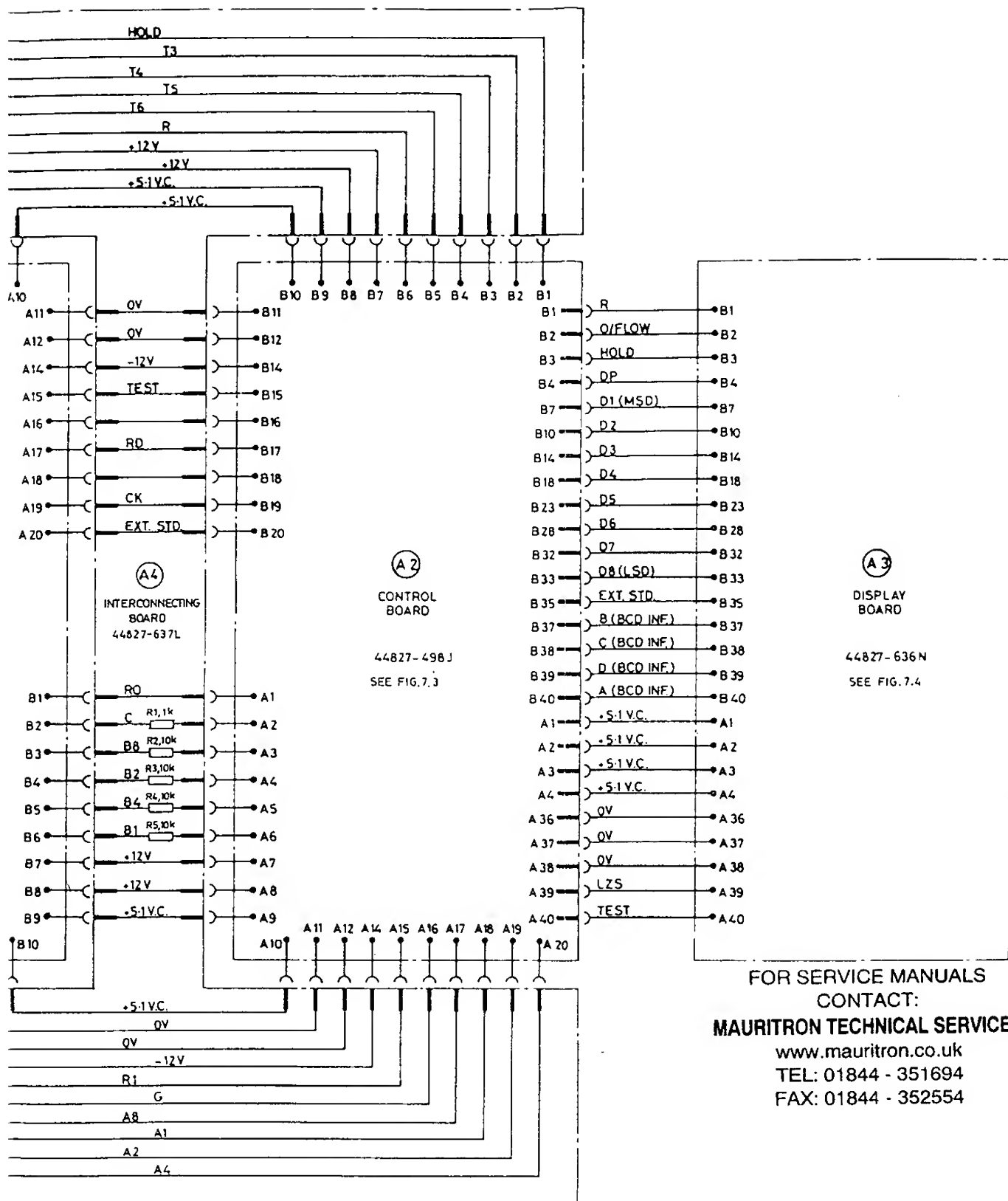


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(Inc Z44827-637L Iss.1)

INTERCONNEC

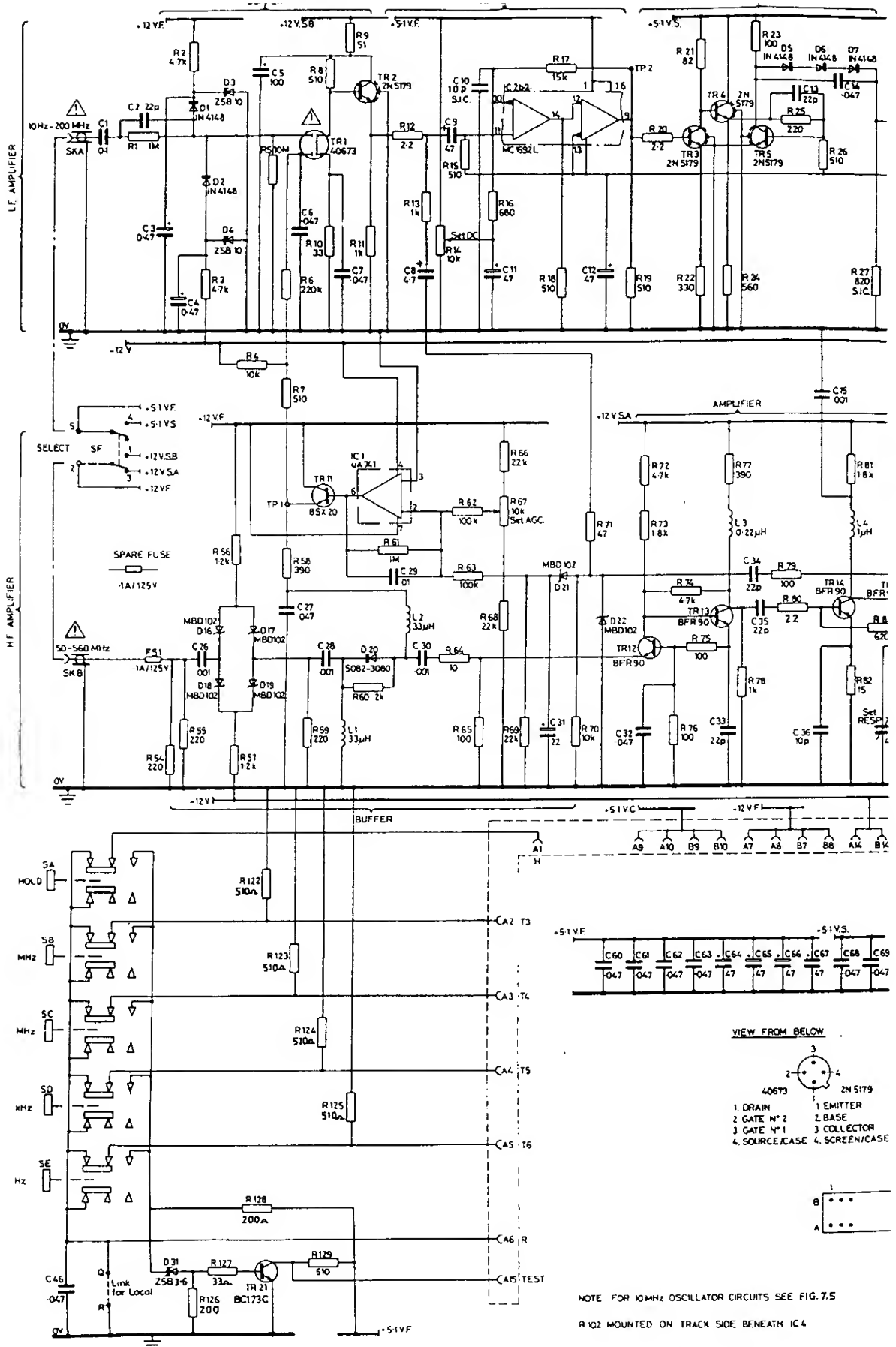


INTERCONNECTION DIAGRAM : A0



ION DIAGRAM : A0

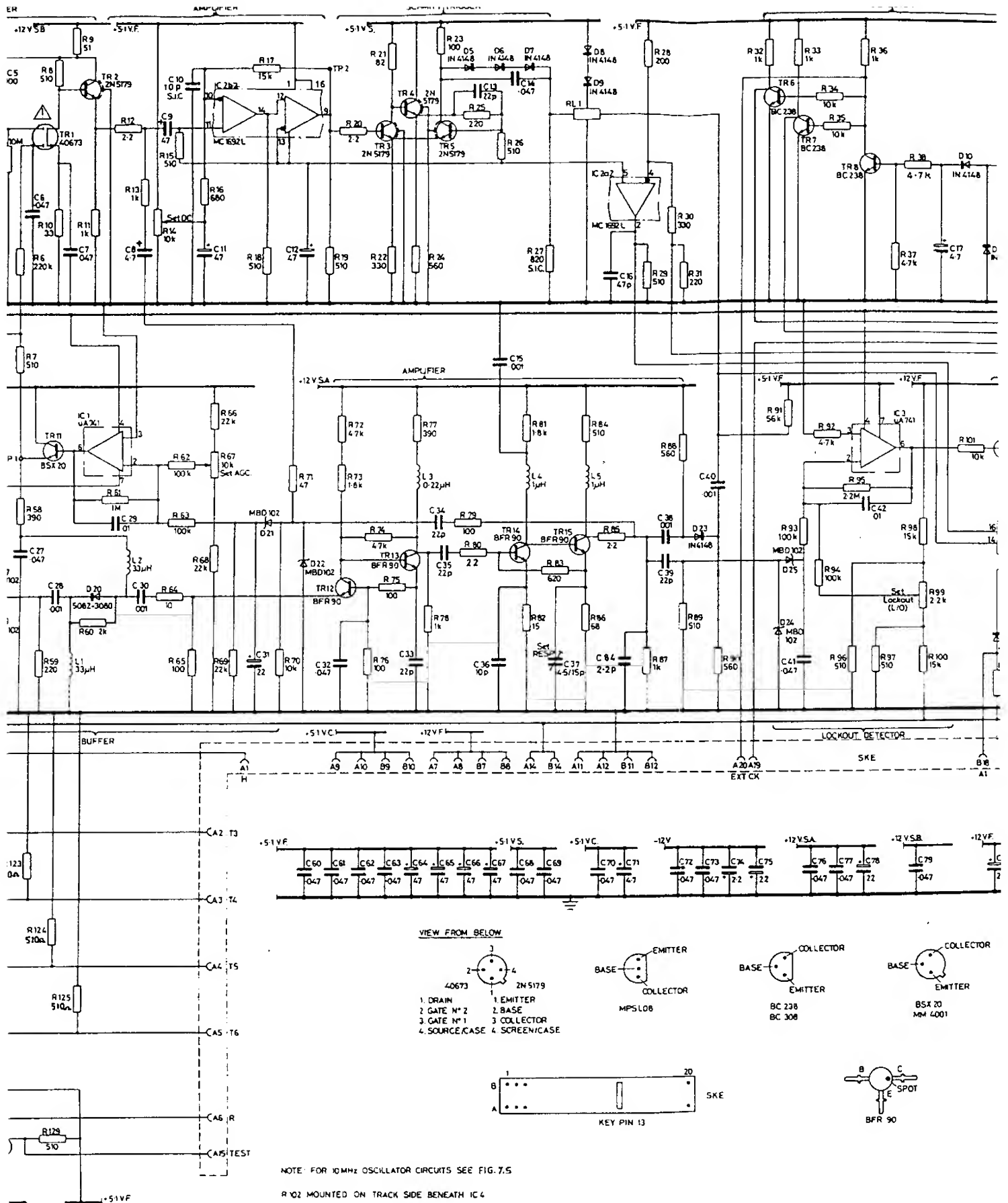
Fig.7.1



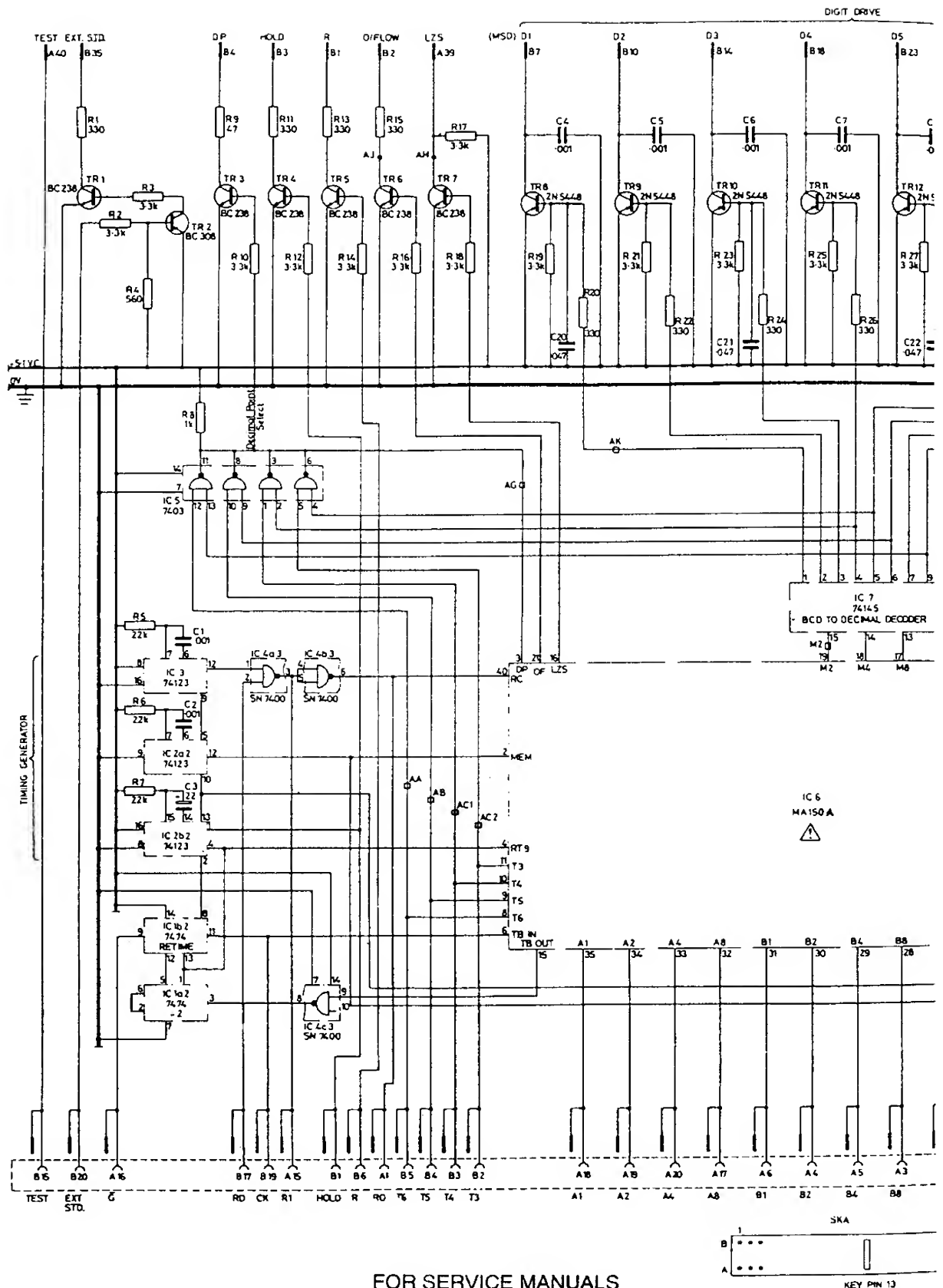
S Z 4 4 8 2 7 - 5 0 0 U 1ss.6

2432-900 (1b)

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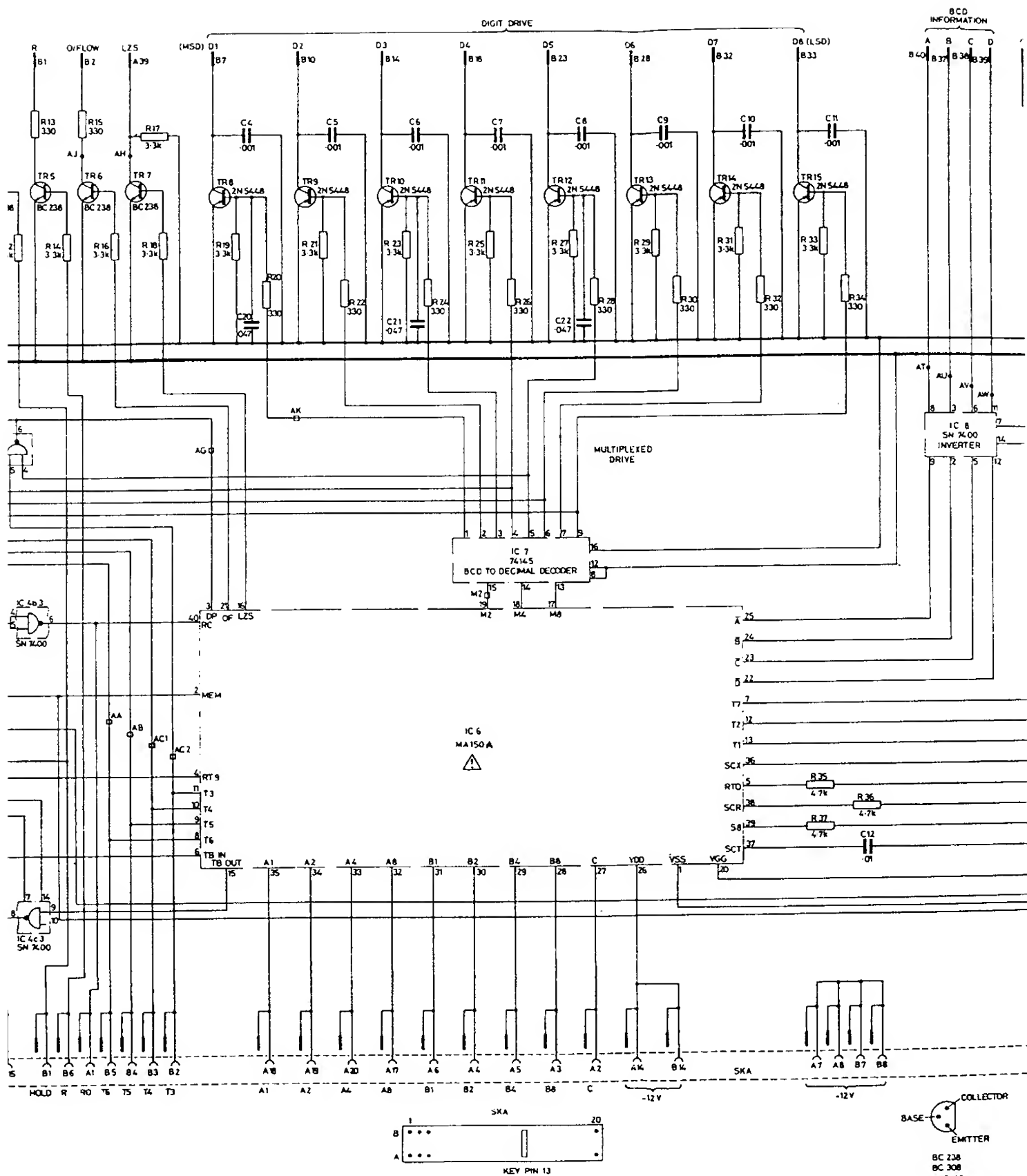


SZ 44827-498J Iss. 3

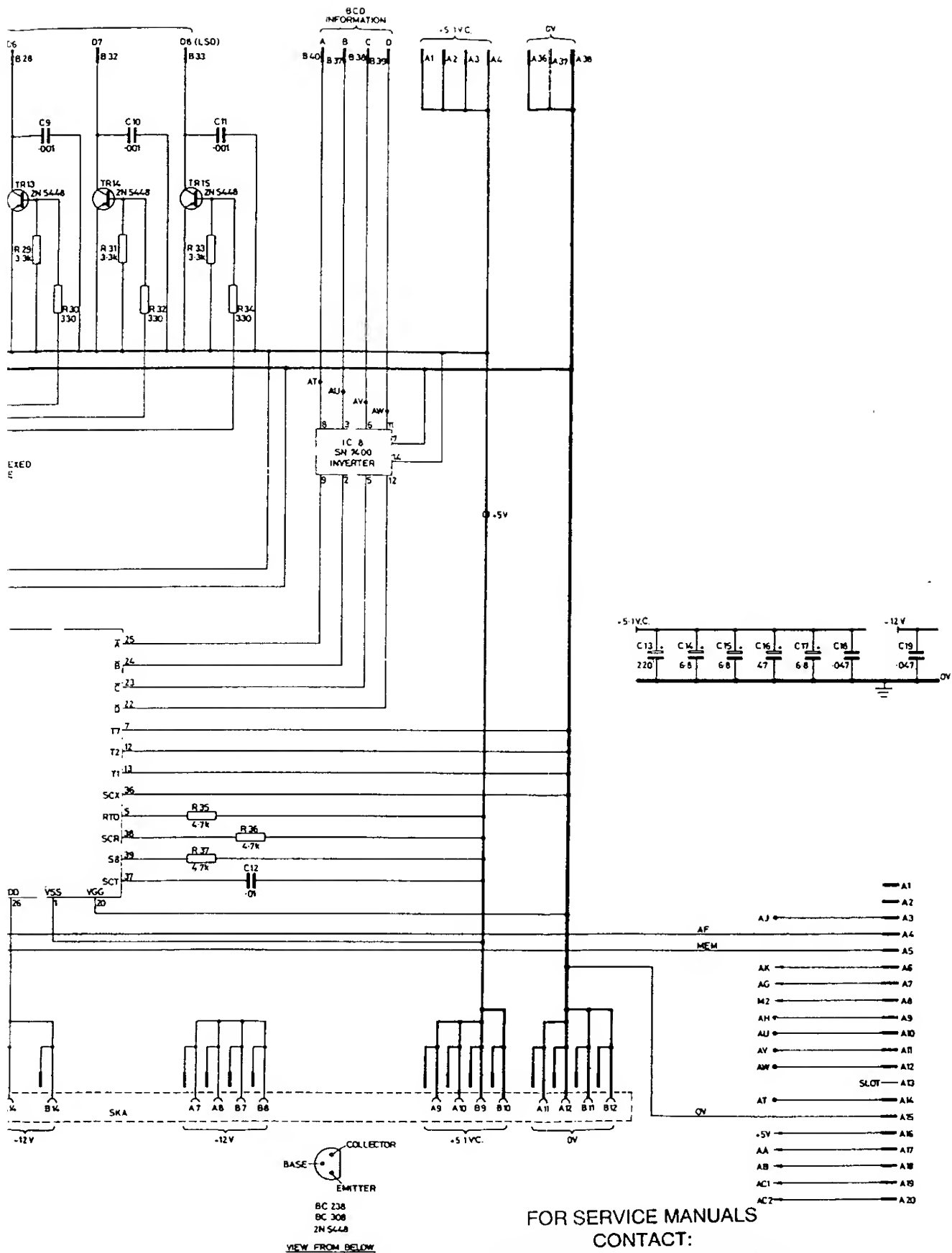
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CONTROL BOARD

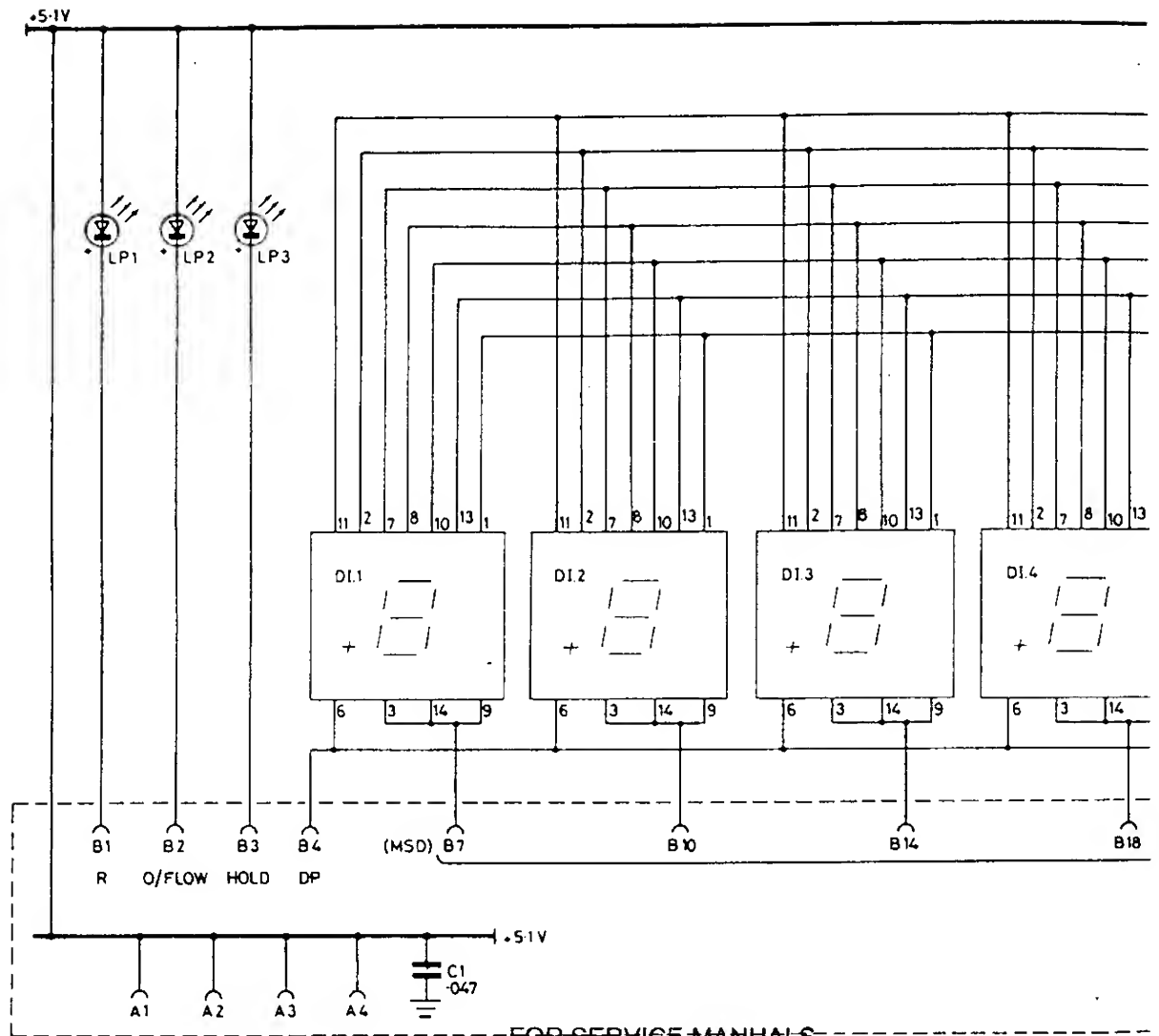


CONTROL BOARD : A2



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Fig. 7.3



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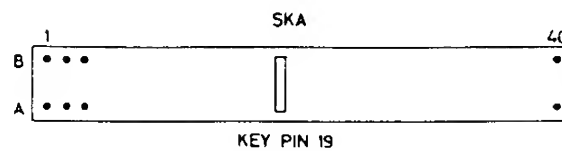
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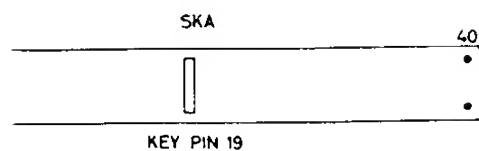
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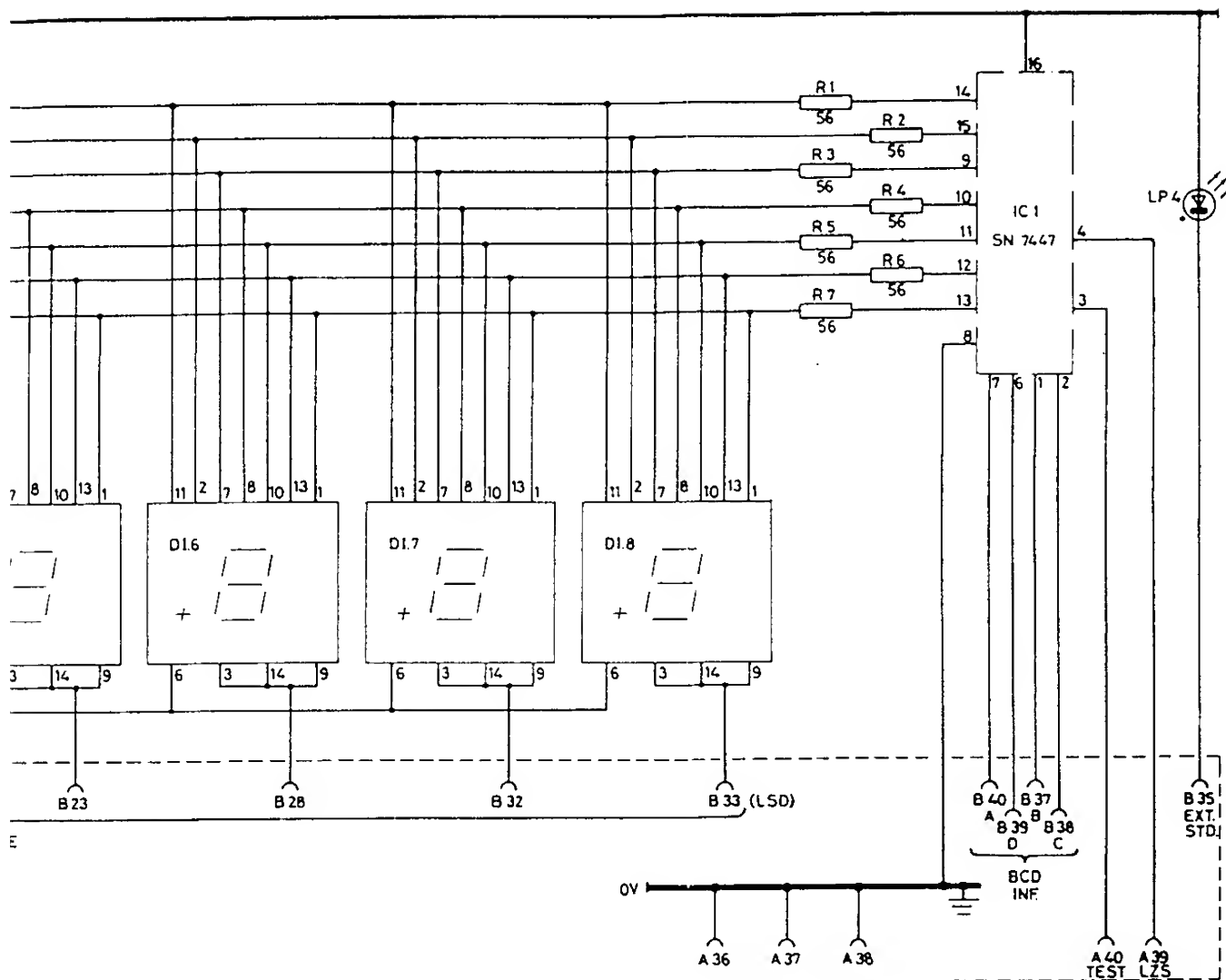
S Z 4 4 8 2 7 - 6 3 6 N Iss.1

DI:



ISS.1

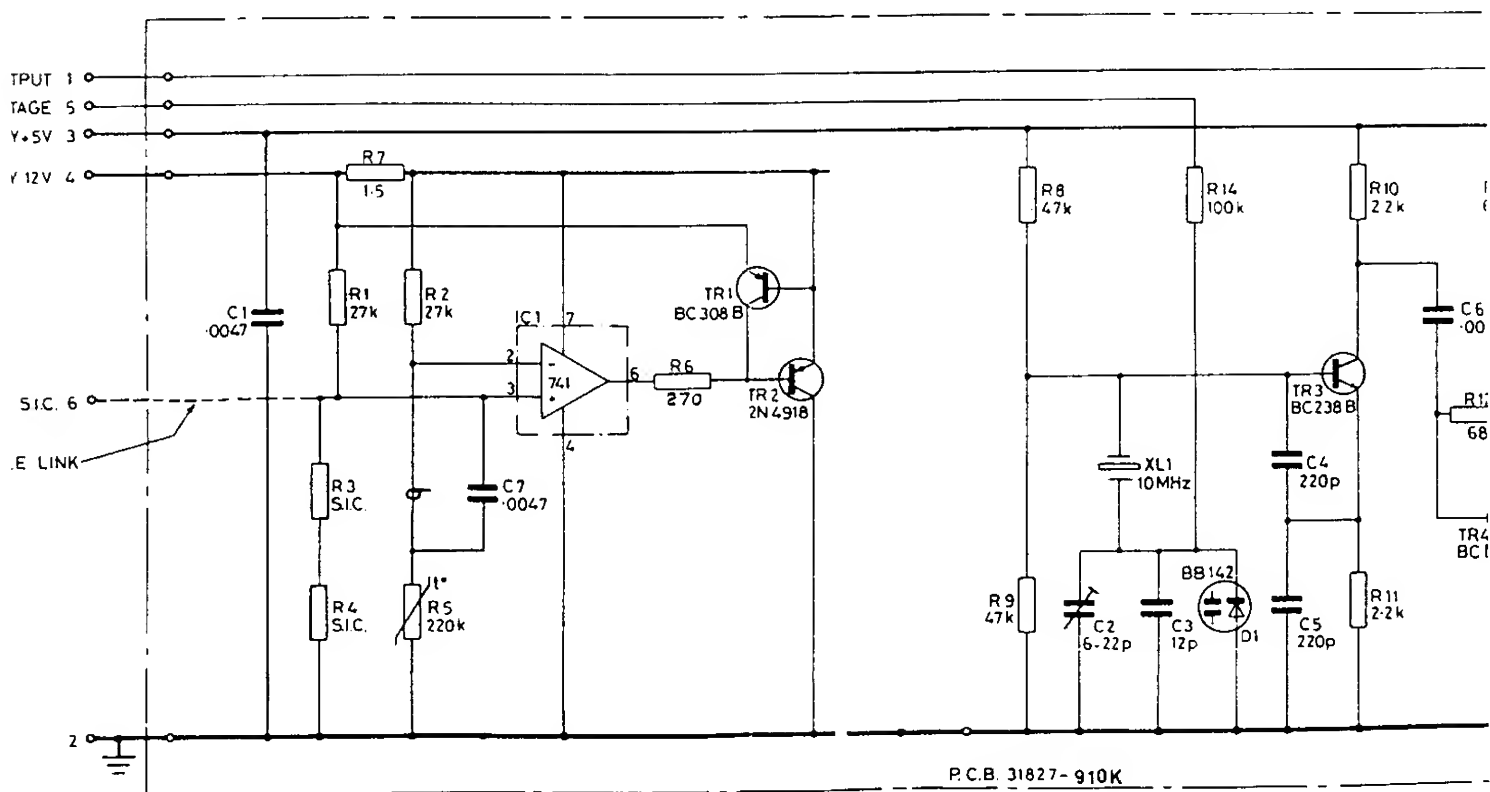
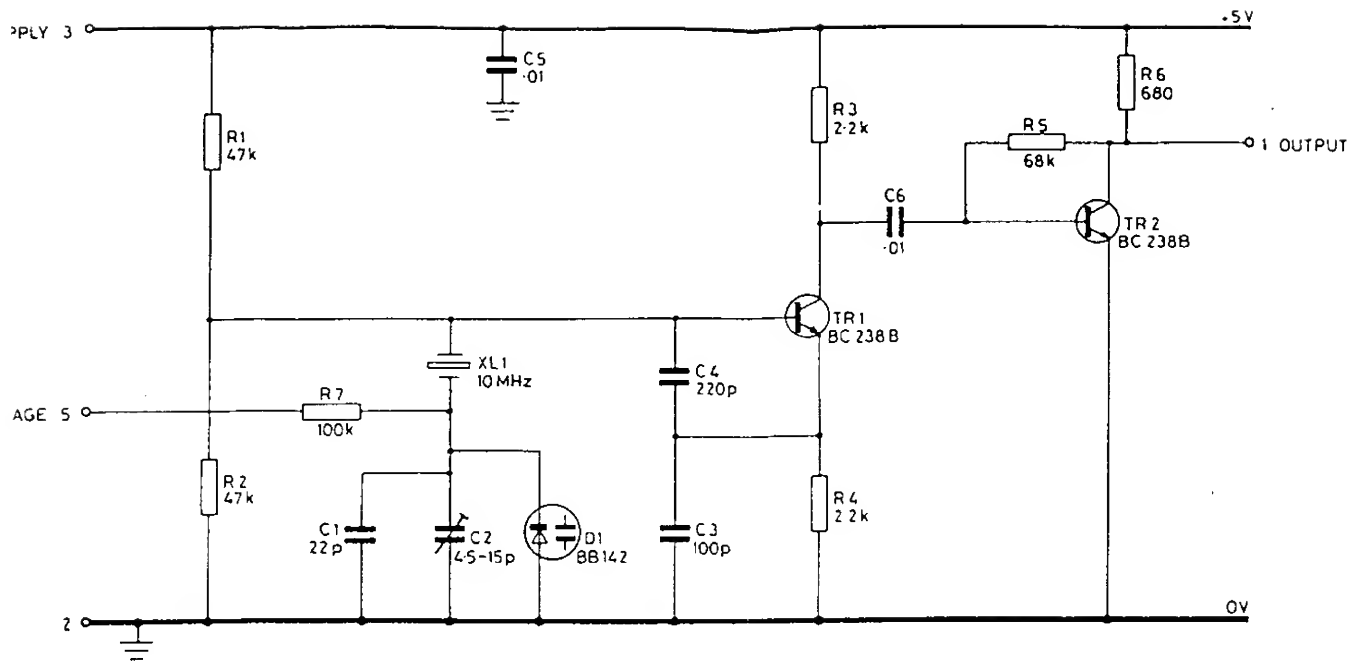
DISPLAY BOARD : A3



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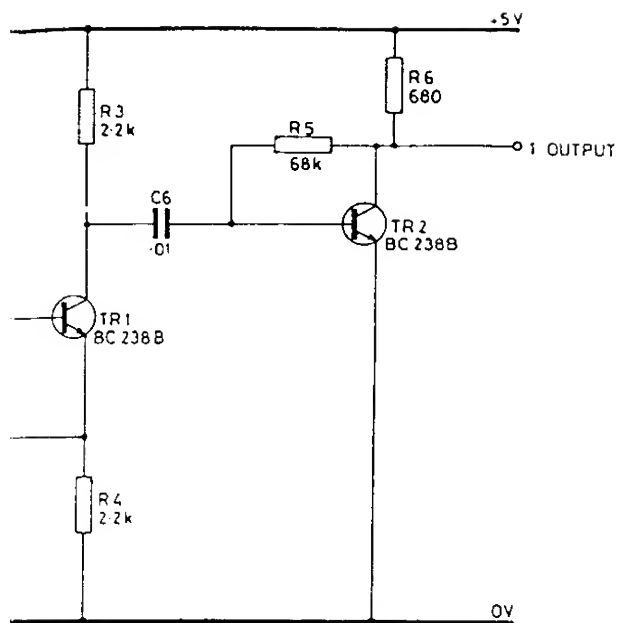
BOARD : A3

Fig.7.4



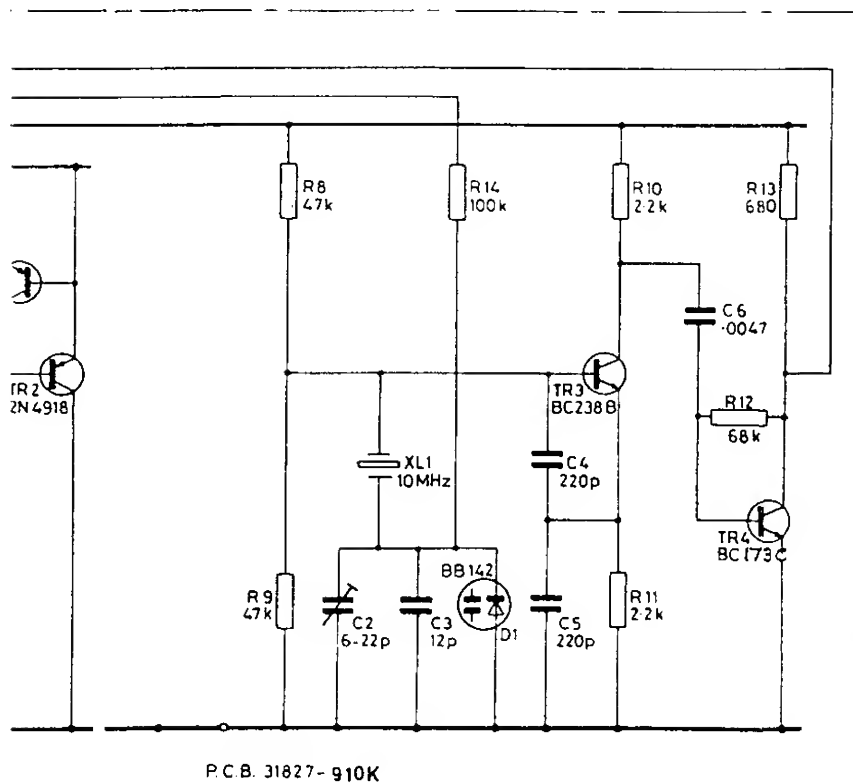
Indicates sleeved wire

10 MHz OSCILLATORS



(A10)

SZ44827-563E
Iss.1



(A11)

SZ44990-195Z
Iss 1

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⎓ Indicates sleeved wire

OSCILLATORS

Fig. 7.5